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The Mount Morgan Gold and Copper Mine

Three Distinct Methods of Mining Are Employed, the Open Cut with Steam Shovel, the Milling System and Square-set Supported Stopes

BY GERARD W. WILLIAMS*

The Mount Morgan mine is situated 25 miles south-southwest of Rockhampton in Central Queenland. The mine itself is only a few miles south of the tropic of Capricorn. It was discovered in 1883 by Messrs. Morgan, who had been prospecting in the neighborhood. Since its discovery the mine has chlorinated 3,250,000 long tons[1] of ore for a return of approximately an ounce to the ton, while half a million tons have been smelted for a return of about 3 per cent. copper and 8 dwt. gold per ton. To July 10, 1908, the total value of gold and copper produced amounted to slightly more than $70,000,000, of which $37,000,000 has been paid in dividends. The nominal capital of the company is £1,000,000.

The surrounding country is composed of highly altered sedimentary rocks traversed by a large series of dikes of varying geological age. The orebody in outline resembles an irregular ellipse, the longer axis running northwest-southeast. In the open cut the axes of the ellipse attain a maximum of 940 and 590 ft. The lowest level (950 ft. vertical) is opened up for more than 600 ft. in length and 250 ft. in width, but ore is still in the face and both width and breadth will be considerably exceeded.

The orebody is traversed by numerous dikes, of which four are extremely well defined. The north and south dikes run parallel, about 450 ft. apart and strike northwest-southeast. These dikes are almost vertical and average 20 ft. in width. The south dike is still in the ore in the bottom level, but the north dike leaves the lode and passes into the country at 650 ft. The east dike is a branch of the south dike and runs in a general northeast direction.

The biggest dike is known from the nature of the rock as the andesite dike. This dike runs north and south and crosses the south dike above the 750-ft. level. This dike was formerly considered the limit of payable ore, and it is only since diamond-drill work was started that the country beyond the dikes has been opened up. Practically the whole of the copper ore, now estimated at more than 3,000,000 tons, lies to the west of the andesite dike. The dike itself averages 20 ft. in width and is almost vertical. It runs across the open cut and standing out from the softer ore it forms a conspicuous feature.

Nature of the Orebody

There is practically no contact enrichment at the dike faces, which show slickensides in some places in the dike matter itself, but give no evidences of having faulted the orebody. The dike material has been considerably altered, the smaller dikes being completely kaolinized; even at the lowest level the surface of the larger dike shows signs of alteration. When one considers that the unoxidized ore averages 25 per cent. pyrites, and that more than 2,000,000 tons of leached ores have been excavated from the open cut the quantity of acid produced by oxidation must have been enormous. It is not surprising, therefore, that all the rocks have been highly altered. The nature of the unoxidized ore varies widely from ultra basic (10 per cent.

OPEN CUTS AND DUMP, LOOKING SOUTH. CONTOUR OF ORIGINAL HILL SHOWN BY DOTTED LINE

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[1]Throughout this article all tons are of 2240 lb. The short ton is not used in Australia, except in West Australia.

silica) to ore containing 80 per cent. silica. Generally speaking, the highly mineralized basic ores are high in copper and low in gold, while the silicious portions of the orebody are rich in gold, but low in copper. The whole of the unoxidized ore may be averaged at 65 per cent. silica and 3 per cent. copper, the balance being chiefly iron pyrites.

Several theories as to the genesis of this orebody have been put forward. The oldest and best known theory was advanced by Dr. Logan Jack, that the deposit was due to a vast geyser. This theory has been completely abandoned, the silicious sinter whch was supposed to occur in the open cut having been shown to be really a stockwork of small veins of infiltrated silica. In the light of recent work at depth it would seem that the ore was deposited from ascending mineral-bearing solutions which permeated a zone of crushed or weakened sedimentary rocks. These rocks were completely altered in their composition and in addition to the deposition of sulphide of iron considerable infiltration of secondary quartz took place.

It is noteworthy that the lode does not shade off into the country rock, but that the line of demarkation of the elliptical orebody and the surrounding rocks is well marked. It is certainly somewhat difficult to account for a crush zone of this shape, and this is the strongest argument against this theory. J. Bowie Wilson, late mine manager at Mount Morgan, recently published several valuable papers[1] dealing with the genesis of this deposit, and from his long association with the mine he is fully qualified to express an opinion. While adopting the theory of upward percolation through a crush zone he finds it impossible to account for the sharp demarkation between lode and country rock.

The gold contents show a natural decrease from the outcrop downward, but in the copper mine the value appears to be fairly uniform. All the copper occurs as chalcopyrite; there are no carbonate ores. Black sulphides occur but rarely and then as impregnations in felsite dikes.

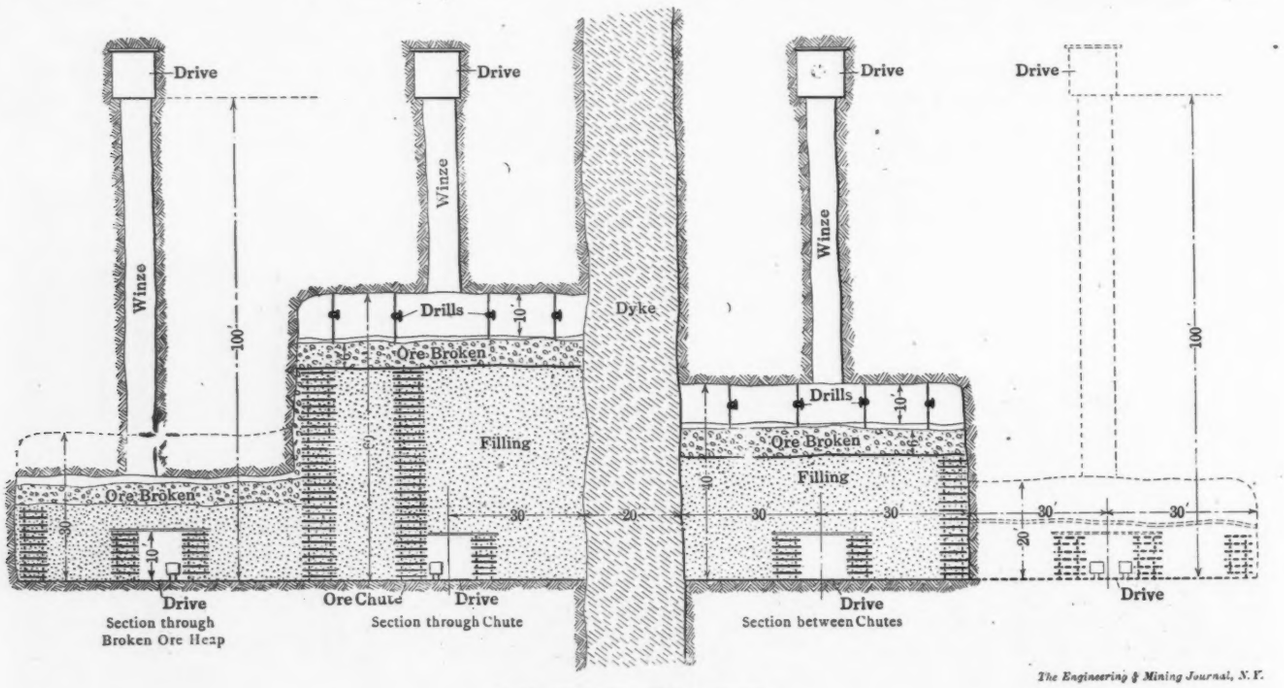
Methods of Mining

The mining methods may be divided into three classes: Open cut in the oxidized ore for supplying oxidized ore for the west chlorination works, the "mundic" stopes, which send ore to the mundic works for roasting and chlorination and the copper mine. The oxidized ore extends to a depth of about 400 ft. below the old hill top; the mundic stopes follow down 500 ft. vertically and then appear the newly opened stopes of the copper mine, which have been opened up down to 950 ft. The whole orebody is continuous and the above divisions are purely arbitrary, for silicious ore low in copper and high in gold occurs in the copper stopes and basic ore low in gold and high in copper has been won from the mundic stopes.

The open cut covers an area of 14.2 acres and measures 1050 ft. and 710 ft. in greatest width and breadth; of this 940 ft. by 590 ft. represents ore.

In the old days the rich gold ore, which occurred in very irregular shoots in the mass of the orebody, was stoped out with square-setting from adit levels driven from the hill side. A few years ago the present management decided that the bulk of the ore would pay to remove for treatment and the present open cut was started. Working down on benches the steam shovels remove the old stope fillings, dike matter and overburden and load it upon electric trams which carry it out through adits in the hill side and tip it into the valley at the side of the mine, or to winzes leading to the stopes below. Two steam shovels are in constant use, a small one having a capacity of 450 tons per shift which is used for opening up new benches and a larger one which follows in the wake of the small one and removes from 800 to 1200 tons per shift.

At the time the estimate was made the ratio of overburden to ore was placed at 4 to 1; but this ratio has been slightly reduced owing to the fact that in many cases the old stope fillings paid for treatment. The cost of removing overburden and waste varies from 10 to 15c. per ton. The bulk of the overburden has been removed and for the last 12 months the ratio of overburden to ore was only 1 to 1.8.



CROSS-SECTION, COPPER MINE

The ore is won by benching and by "milling." In the former method the faces of ore left by the steam shovels are broken down by deep, vertical "jumper" holes and the broken ore is shoveled into ore passes leading to the 450-ft. level below, or is removed by the small steam shovel.

Milling System

The milling system was borrowed, I think, from America. It certainly merits a few words of description for it is not so well known as it should be. A level is driven into the face of the ore from the floor of the cut and from the end of the

[1] *Aust. Mining Standard*, Aug. 12, 1908, *et seq.*

level a rise is put up to the surface. The rise is fitted up as an ore chute and rails are laid into the level. Starting at the surface opening of the rise the ore is broken into it from all sides. The miners work back from the opening of the ore pass in such manner that the sides of the conical "rill" are steep enough to allow all broken ore to fall down to the ore pass in the center.

Viewed from the crest of the big andesite dike which crosses the open cut the chine men $2.24 to $2.40 per eight-hour shift. The floor of the open cut is now 340 ft. below the crest of the old hill. The dotted line in the accompanying illustration shows the former contour of the hill.

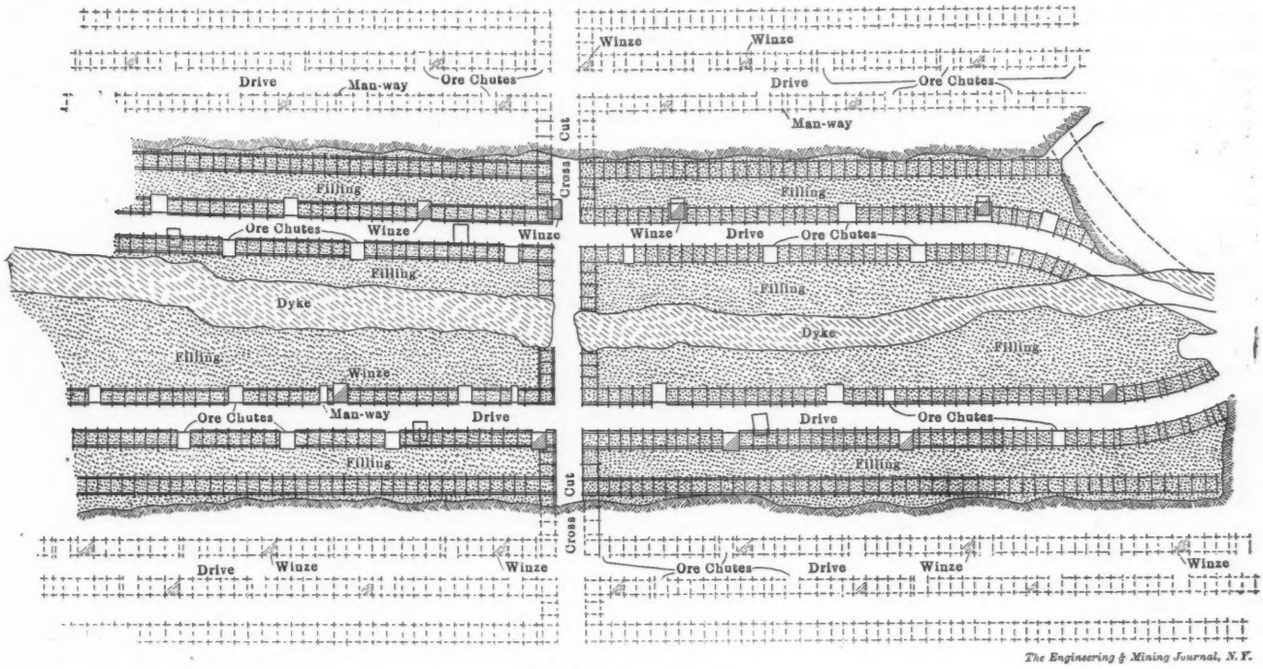
The Mundic Mine

The stopes in this portion of the orebody are worked by the square-set method. The sets measure 6x5 ft. between centers on the sill and 7 ft. 9 in. in hight. The swinging sets the price for breaking ore and erecting sets varies from $16.20 to $22.40 per set, and for sill floor sets from $30 to $42. A set averages 23 tons of ore.

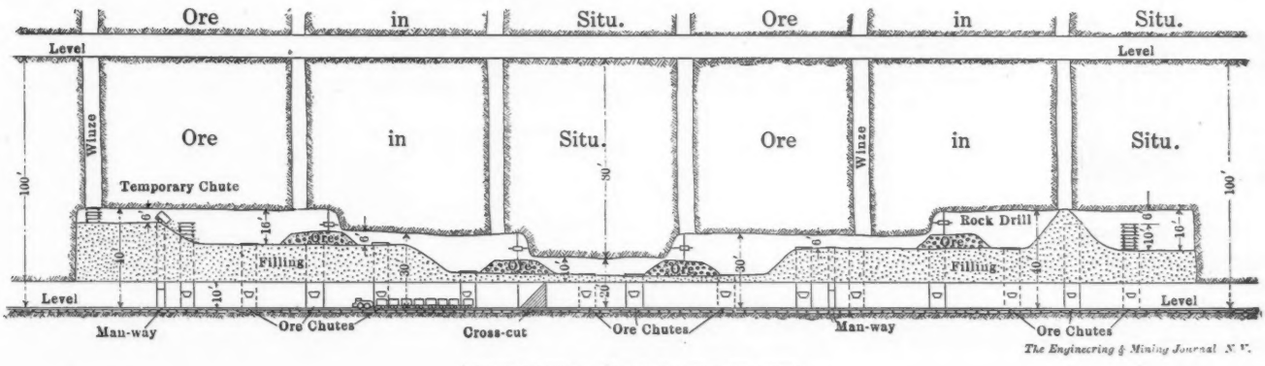
The total costs average $2.97 per ton, and development 50c. per ton mined.

The Copper Mine

The copper stopes are all to the west of the big andesite dike, which for many years was considered to be the eastern limit of the payable orebody. Six



PLAN OF COPPER MINE



LONGITUDINAL SECTION, COPPER MINE

"mills" appear like so many gigantic antlions' pits. Some of these mills measure 200 ft. across; but their size naturally varies within wide limits as adjoining mills encroach on each others' territory.

COMPARISON OF COSTS OF MINING, PERIOD OF SIX MONTHS.

Benching System.	
Ore and waste (65,103 tons)	49c.
Ore charged with waste (32,962 tons)	82c.
Milling System.	
Ore and waste (71,632 tons)	26c.
Ore charged with waste (32,962 tons)	43c.

All labor in the open cut is by day's pay. Miners earn from $2 to $2.24, and timber is all square-cut 9x9 in., and is joggled in the usual manner except that the struts are given a 1-in. shoulder instead of carrying the full-sized tenon. The wood used is known as spotted gum and is obtained locally. It is stronger than Oregon pine and stands well. It does not, however, "talk" when taking weight, but is liable to snap suddenly. The timber costs $3.40 board measure and is cut from the logs in the company's mills. Per ton of ore the cost of timber averages 44 cents.

The ore is mined by contract, the contract price being based on the number of square sets and not on footage nor tonnage. On years ago diamond drilling was started and large masses of copper ore were located. For three years systematic exploratory work was carried out and at the end of that time 3,000,000 tons of 3.5-per cent. ore had been located. This drill work cost $150,000. As soon as the ore was proved a smelting plant was erected at a cost of more than $1,000,000 and was paid for out of the profits on one year's work. Without calling up a cent of capital and without interfering with the production of gold the Mount Morgan mine commenced a new existence as a copper-smelting enterprise. Typical secondary

ores were entirely absent from the upper levels and the portion of the orebody which contains the copper ore was previously regarded as valueless.

The mine is opened up with levels at 450 (the mundic level) 574, 650, 750, 850 and 950 ft. vertical depth. Only the 750- and 850-ft. levels in the copper mine are at present being stoped. The main underlay shaft is down 1035 ft. vertically.

The orebody, which may be taken as 650 ft. in length and anything above 260 ft. in width is opened up by means of drives parallel with the longer axis of the orebody and 60 ft. apart. Large crosscuts run at right angles to the main drives. This method of development blocks the ore out into panels or chambers 60 ft. wide and usually 250 ft. to 300 ft. in length. The ground plan of the sill floor thus determined, stoping commences in one or other of the center chambers.

Method of Working

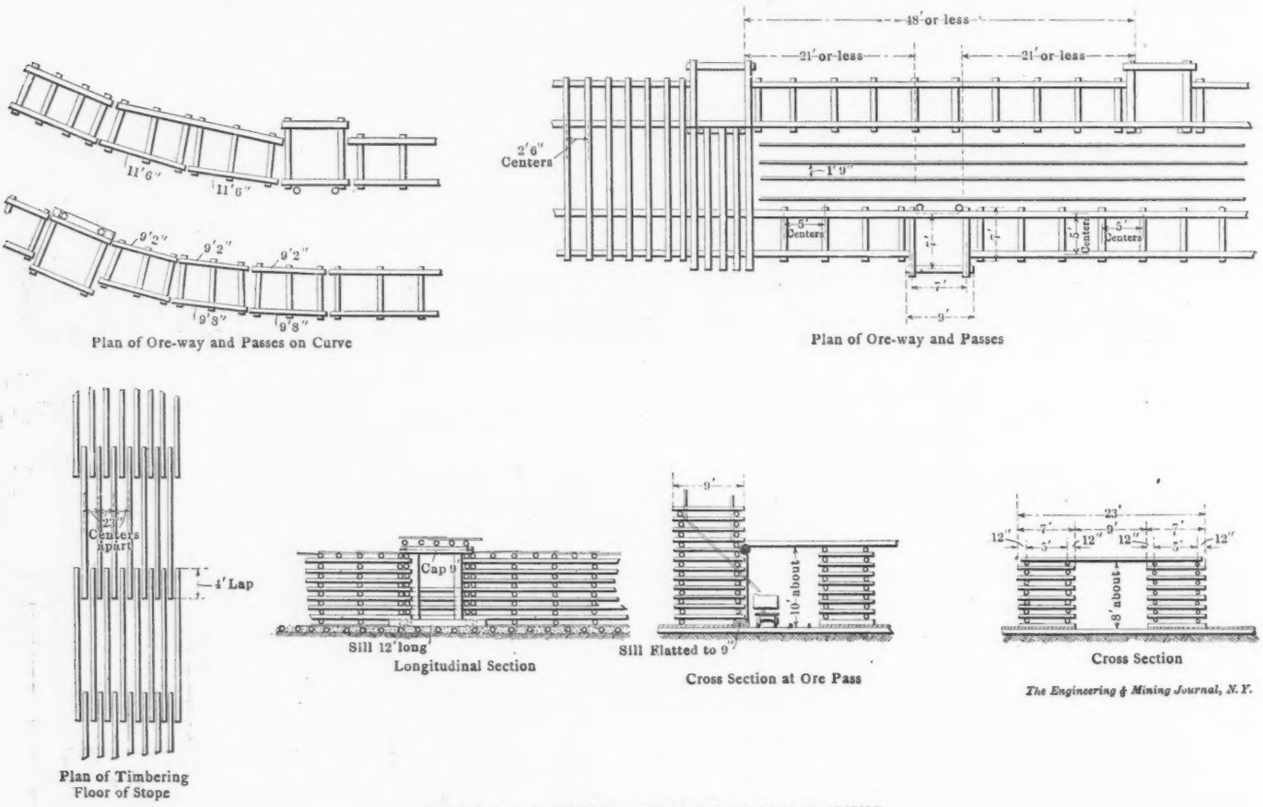
The ore being vertical there is no need to begin from the footwall side. The sill floor is cut out and the leading stope carried to a hight of 14 ft. above the floor of the sill. Bulks of timber, composed of old square-set timbers recovered from the old stopes laid bare in the open cut, are used to support any heavy ground in the roof. The sill floor is laid with logs of brigalow, a cheap timber which occurs locally and which stands well underground. The bed logs are floored with 4-in. planks of Colonial pine.

Along the sides of the chamber a continuous line of solidly built pigsties is erected which form the sides of the drives and crosscuts and ultimately convert the whole chamber itself into a gigantic waste-filled pigsty. Waste is sent down from the open cut and distributed by winzes to the chambers. Ore passes are placed in the level every alternate 15 ft. Once the sill sets are in and the waste spread and leveled out, another face is taken off the stope and the filling repeated. Meantime the adjoining chambers are working up, each inclosed in its wall of pigsties.

The accompanying plans, supplied by the management for the purpose of illustrating this article, explain the whole system very clearly. It will be noticed that all drive timbering is done away with and the expensive sawed timber sets are replaced by a wall of round logs slightly joggled into each other.

In every way the method appears to be extremely safe; not only does the panel system eliminate the possibility of "creeps" caused by the crushing of wide spans of ore as the stope works up to the level above, but by the use of bulkheads the danger of small falls of rock is lessened or entirely done away with. At the time of my visit a few months ago 300,000 tons of ore had been excavated without a single accident; then, without warning, came three disastrous falls, two of which were attended by serious loss of life. The ore, although apparently absolutely solid gave way in masses weighing several thousand tons and crushed down the bulkheads until it rested on the waste beneath.

The government is at present holding an inquiry into the causes of the accident, and will doubtless recommend some other form of stoping practice. Probably the use of a larger number of bulkheads in the working faces, each bulk being filled up with broken rock, will enable the present method to be continued. The frequency or otherwise of serious accidents is not always a fair criterion of safe working, for there is at times something of "cussedness" in inanimate matter that defies all laws, and it is not improbable that were the present method continued no more accidents would occur.



TIMBERING METHODS IN STOPES OF COPPBR MINE

Labor and Wages

All miners, except those employed in the open cut are contract workers. In the copper mine the men work in gangs of 16 to 24. Usually the gang or party rig up and bore out a face right across the chamber; the face in then fired and while one machine is employed squaring off the face the rest of the party spall up the ore and deliver it to the ore passes.

The ore is taken to the plat by an electric tram and every truck is weighed as it passes to the plat. The contract men are paid on the actual weight of ore sent up. The price paid varies from 66c. to $1 per ton, the higher rate being paid in the sill-floor stopes.

Mining costs in the copper mine are abnormally high at present; out of six work-

ing stopes four are on the sill floor and the cost of flooring boards, etc., runs the costs up. Dike material represents 13 per cent. of the total ore broken. This is sorted in the chambers; at one time it was sorted on a belt at the surface but the cost was too high. The main underlay shaft carries two skip ways; each skip carries from seven to ten tons according to the nature of the ore. The trucks from the levels are tipped into bins in the floor of the level which discharge through chutes to the skips.

Mining costs for the six months ending May 31, 1908, averaged $2.28 per ton. The ore reserves of the copper mine (down to the 850-ft. level) are estimated at 1,280,000 tons containing 3.5 per cent. copper and 8 dwt. gold and 1,700,000 tons containing 3 per cent. copper and 2.5 dwt. gold. This does not include ore in the mundic stopes or in the open cut. The former is estimated to be equal to ten years' supply for the mundic plant, approximately a million tons.

Short Talks on Mining Law—XIV

By A. H. Ricketts*

The use of water on the public domain was primarily regulated by miners' rules, regulations and customs. The vested and accrued rights in water, recognized and given by local legislation and the decisions of the courts, received early recognition and sanction from Congress. The appropriation and use of water are now regulated by local statutes, which vary in detail, and the rights of the appropriator depend upon his compliance with these local laws. Grants of the public lands are made subject to all water rights that may have previously accrued to any person other than the patentee. In forest reserves rights of way for the construction and maintenance of dams, reservoirs, water plants, ditches, flumes, pipes, tunnels and canals within and across the forest reserves of the United States are granted by congress for mining purposes and for the reduction and milling of ores during the period of their beneficial use under such rules and regulations as may be prescribed by the secretary of agriculture, and also subject to local statutes. Congress has also provided for rights of way through the public lands, forest and other reservations of the United States, and through the Yosemite, Sequoia, and General Grant national parks, of California, for canals, ditches, pipes and pipe lines, flumes, tunnels, or other water conduits, and for water plants, dams and reservoirs used to promote mining or quarrying or the cutting of timber. Lands valuable for mineral deposits and embraced within a withdrawal of lands susceptible of irrigation by means of a reclamation project under the Act of June 17, 1902, are not taken out of the operation of the mining act, but continue open to exploration and purchase under such law.

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Water Rights

All surplus water over and above that necessarily used for the purposes of irrigation and reclamation of desert land, part of the public domain, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable may be appropriated for mining purposes when not violative of the reasonable rights of others. But the right to appropriate water is not confined to streams running over public lands of the United States, but exists whenever the appropriator can find water which has not been appropriated or in which no other person has or claims superior rights and interests and by the latter only as far as there is a conflict.

The size of the stream is immaterial. It may run upon or beneath the surface of the land (but it must be separate and distinct from the soil whether produced by percolation, filtration or otherwise), flow in a river or down a cañon or ravine, or it may consist of percolating waters collected or gathered in a stream running in a defined channel or of water flowing from a well, whether flowing away or standing in a pool or a small lake, or flowing from springs or developed in a tunnel and conducted away, by owners of adjoining lands, from land where the waters would otherwise in their natural course sink into the ground and be lost. A person who enters upon the public lands and digs a well has a superior title to the use of the waters from the well. Until the performance of the conditions upon which the right to forever maintain possession is based, the person taking possession has no title legal or equitable as against the Government.

Tide Lands

Lands "under tide water" or "below high-water mark," "lands flowed by the tide" and other expressions of like import are usually employed in defining tide lands. The term "shore line" has been construed to mean high-water line. Lands under tide water are vested in the United States and are not subject to exploration, occupation or location under the mining act, except that in Alaska temporary possession thereof may be had for mining purposes subject to such general limits as may be necessary to exempt navigation from artificial obstruction. So, a mill-site location cannot lawfully be made in Alaska within 60 ft. of the "shore line" of navigable streams, etc.

The term "miner's inch" is not definite without specification of the head or pressure. In California the standard miner's inch of water is equivalent to 1½ cu.ft. of water per minute measured through any aperture or orifice.

Timber Cutting

Timber on mineral lands may be felled and removed by citizens and *bona fide* residents (but not by railroad corporations) of Arizona, Colorado, North and South Dakota, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming and all other mineral districts of the United States for mining, smelting, roasting of ores or other domestic purposes.

Land chiefly valuable for timber may be acquired under the provisions of the "timber and Stone act." Where the character of land sought to be acquired under that act is put in issue, entry will be allowed by the Land department only when it appears that the growth of timber thereon is so extensive and so dense as to render the tract as a whole, in its present state, substantially unfit for cultivation, and that the land is chiefly valuable for the timber thereon.

Miners and prospectors have the free use of timber and stone within a forest reserve for mining, prospecting and other domestic purposes under such rules and regulations as may be prescribed by the Government. The secretary of agriculture may permit the exportation of timber cut or removed from the forest reserves of the United States or the district of Alaska, except the Black Hill forest reserve in South Dakota and the forest reserves in Idaho.

A valuable growth of timber upon land located as a placer claim may properly be an incentive to its location; the validity of this location will be upheld if otherwise unobjectionable. So, if any land is in fact mineral in character, title to the land, together with the timber thereon may be acquired under the mining act and, if vacant and non-mineral and chiefly valuable for timber, but unfit for cultivation and containing no mining or other improvements, it may be purchased under the provisions of the "Timber and Stone act."

The Victorian government's antidote for cyanide poisoning is put up in the form of a package containing the following: A hermetically sealed bottle containing 7½ grams ferrous sulphate dissolved in 30 c.c. water; a bottle containing 1½ grams caustic soda, dissolved in 300 c.c. water; and a tube containing 3 grams of magnesia. The ingredients are to be mixed and introduced into the patient's stomach through a rubber tube which acts as a siphon for emptying the stomach of its poison. The package is to be hung in some easily accessible place in the mill.

Mine timbers placed near decaying wood, according to a bulletin of the U. S. Forest Service, decay much more rapidly than if they are isolated, infection being communicated from the diseased to the new timber.

Tonnage Estimation in Dumps, Open Cuts, Etc.

The Density Factors for Solid and Broken Ore, Tailings and Slime Are Discussed, and Different Methods of Measuring Tonnages Described

BY R. J. DONALDSON*

In estimating the weight of material in any orebody, bin, or heap, the volume is first found, and then divided by a density factor, generally the number of cubic feet per ton. I will deal with the determination of this factor first, and for shortness will refer to it simply as the factor for the material under notice.

Density Factor

This determination is really the most difficult and unsatisfactory operation in the estimation of tonnages. The value of the factor may vary largely for any material according to conditions in themselves impossible to determine. For instance, take rough, crushed ore in a bin. A mixture of sizes is heavier, bulk for bulk, than any one size alone, so that the factor for the crushed ore will vary with the proportion of coarse to fine. The factor used will nearly always be so many cubic feet per ton dry weight, but the moisture content may make a big difference in the packing of the ore, and, of course, differences in the assay value and in the constituents of the gangue will affect the figure.

These variations in the factor may be so great as to render an estimate little better than a guess. The concentrates from the various flotation processes are particularly liable to vary, and I have known one case in which the factor ranged from 15 up to 30 cu.ft. per ton.

Relations of the Factor for Solid to that of Broken Ore

In the appendix to "Ore Dressing," by Prof. R. H. Richards, the following authorities are quoted: Vezin, for "fairly finely crushed" ore, makes the factor for broken ore 1.75 times that for solid; Kirby, for run-of-mine ore, broken, 1.53 to 2 times the solid; McDonald, probably for run-of-mine ore, factor for broken 1.74 to 1.85 that for solid ore.

Examples of Broken Hill practice are 1.6 to 1.73 times the solid factor. Trautwine states that 1 cu.yd. solid breaks to from 1.75 to 1.9 cu.yd. in ordinary excavating. He also gives figures for three sizes of clean quartz sand. The coarsest contains 41 per cent. voids, the finest 50 per cent., i.e., the factors are 1.7 and 2 times the solid factor respectively. This is for loose sand. The medium sand gives intermediate values.

These figures for sand, taken by themselves, seem to confirm the often printed statement that the finer the crushing the bigger the percentage of voids, and, therefore, the higher the factor. But compare the coarse-sand factor with that given by the same authority for rough, broken material, and the two are found to be the same. Again, the coarse sand well shaken and jarred has a factor of only 1.47 times that for solid, and so is then heavier than rough, broken material.

In this connection the following table of factors (cubic feet per long ton) for different sizes of anthracite, given by C. Enzian, in a paper in the Engineering and Mining Journal for July 27, 1907, is interesting:

CUBIC FEET OF ANTHRACITE PER LONG TON.

Buckw't.	Pea.	Nut.	Stove.	Egg.	Broken.	
41.4	42.1	38.4	38.5	38.8	39.4	—Lehigh.
40.4	41.1	39.4	39.8	40.0	40.1	—Wyoming.

It appears that the factor drops, i.e., the material gets heavier as the size diminishes from "broken" to "nut," jumps to a higher value than ever at "pea" size, and then falls again at "buckwheat."

The truth seems to be that the finer the crushing the lighter, bulk for bulk, the material may be, but at the same time it becomes more compressible, and the factor is affected to a much greater extent by the conditions of deposition.

The following experiments on the factor for Broken Hill mill slimes show how greatly it, a very fine material, varies in weight according to these conditions. The experiments were carefully conducted in a strong tin holding about ¼ cu.ft., the volume being found by weighing it empty and then full of water.

The values for tailings show that they are less sensitive to conditions of deposition, but still vary greatly.

By measuring a dump of tailings before and after a known weight—some hundreds of tons—had been removed, a factor of about 18 was obtained.

Unfortunately there is no connection between the two sets of figures, and a set of careful experiments seems to be needed on the density of the same material in different sizes. I have come across very little literature on the subject.

The Actual Determination of Factors

In estimating the tonnage in any underground orebody, it is necessary to know the number of cubic feet of solid ore required to weigh a ton. The determination

DENSITY FACTOR FOR SLIME UNDER DIFFERENT CONDITIONS.

	Cu.Ft. per Ton (dry).
Dry slime, lightly shaken	25.8
Slime with 2 per cent. water, well rammed	19.6
Slime with 9 per cent. water, well rammed	18.4
Paste, 23 per cent. water	22.0
Same paste, dried in sun to 6.5 per cent. water	18.0
Weighing the slime dug from a hole in a dump 2-ft. cube gave a factor on the average of	19.0

DENSITY FACTOR FOR TAILINGS UNDER DIFFERENT CONDITIONS.

	Cu.Ft. per Ton (dry).
Loose, dry	20.32
Dry, well rammed	17.08
Dry, well rammed (repetition)	16.83
2 per cent. water, well rammed	18.04
15.5 per cent. water, well rammed	18.08

of the specific gravity of specimens will give an approximate figure, but an allowance, say, 5 or 10 per cent., or even more, will almost always be necessary for vugs, etc. In the case of lode material which varies in density, the specific gravity of typical specimens of the different classes of ore should be found, and an attempt made to average the figures obtained, according to some estimate of the relative quantities of the different classes.

Much the best way, however, in an established mine with reliable records, is to measure the volume of the depleted stopes on any one level, from the cross-section, in the same way as the reserves would be measured or the volume might be calculated from the floor plans. From this volume and the recorded extraction from the level, the factor is easily obtained. It is generally possible to find a recently opened level with a reliable record of extraction. The factor got in this way is, of course, exactly the figure required, being the number of cubic feet as represented on the cross-sections or floor plans necessary to be mined to produce one ton of ore. It should agree approximately with the theoretical factor; otherwise there is likely to be some serious error in the method used for finding the volume.

Factor for Rough Broken Ore

Estimating the factor for rough broken ore is difficult. Having found the factor for ore in place, it may be multiplied by one of the figures given by Trautwine and other authorities to get the factor for broken ore. Sometimes an opportunity occurs for measuring a bin before and after a known weight of ore has been put into it. Or a railway truck full may be very carefully measured up and weighed.

Factor for Tailings and Concentrates

As mentioned before, the conditions of

*Broken Hill, New South Wales, Australia.

Note—Abstract of paper read before the Scientific Society of Broken Hill, and published in *Aust. Min. and Eng. Review*, Dec. 5, 1908.

deposition affect the figure for these fine materials so much that the determination is very difficult and unsatisfactory. In the case of concentrates it is generally possible to get a figure by shipping and weighing the whole of a heap (or contents of a bin) previously carefully measured. In the case of tailings and slimes, it is not often that this can be arranged, and we have to fall back on weighing a known and necessarily small volume. The figures already given show how unreliable the data obtained in this way may be. It is obvious that, under these conditions, it is absurd to waste time on a fine determination of volume when an error of 5 per cent. or more may unavoidably occur in the density factor. It is also obvious that an estimate can only be after all an estimate, and not an exact measurement.

Measurement of Volumes Underground

The chief problem is the estimating of ore reserves. In a lode of uniform width, the area of proved but unstoped ore as shown on a projected longitudinal section should be taken and multiplied by the width measured normal to the section. Sometimes a simple arithmetical calculation is all that is necessary. In a wide, irregular lode, such as the Broken Hill lode, there are two chief methods. The first is to multiply the mean of the proved ore areas (whether stoped or not) on two adjacent levels by the distance between them, and afterward to subtract the recorded extraction between these levels. As the mean-area method gives a value too high when the end areas differ much, in such a case it would be better to use the prismoidal formula. The middle area would be got by plotting a plan halfway between the levels, by the aid of the sections and floor plans. The second method is much better. It is, however, necessary to have accurate cross-sections of the lode at frequent intervals, the frequency, of course, depending on the irregularity of the orebody. In Broken Hill practice the sections are spaced at intervals varying from 20 to 50 ft. The mean of the areas of proved unstoped ore on any two sections is multiplied by the distance between these sections. This method is more laborious, but much more exact, as it takes into account bulges, etc., between the levels. It has two other great advantages. No reliance is placed on records of extraction, whch are often very unreliable indeed, especially in the older levels; and the tonnages are obtained separately for each section of each level—a very important point, as it is often desirable to know the approximate tonnage to be won by carrying out some particular piece of repair or development work.

An estimate of ore reserves might, of course, be made by finding the area of ore left unmined on each floor plan, but the conjectured wall would generally have to be drawn in on the cross-sections and transferred to the floor plans; moreover, the tonnage in each separate floor of a level would be a figure of no practical value.

Underground Excavations

In Australia these are generally measured in cubic fathoms. In the case of measuring up fathomage for stoping contracts in a narrow lode of fairly uniform width, the stoping may be plotted on a projected longitudinal section, and the measured widths (normal to the section, not necessarily to the lode) figured on in their correct positions. By narrow lode, I mean one in which the whole lode from wall to wall is taken out in one stope. The area of stoping on the longitudinal section is then multiplied by an average of the widths over that particular area. Care should be taken in averaging the widths over any area to give each measurement its proper value. For instance, suppose we have a square with widths as shown, the mean width is not the sum of the widths divided by nine, but is obtained thus:

2x1	—	2
3x2		6
5x1		5
3x2		6
5x4		20
7x2		14
2x1		2
4x2		8
8x1		8
	16)71	
	4.43	

If the widths of the small squares are averaged separately, and the mean width of the four averaged again, the corner widths will be used only once, the side widths twice, and the center width four times.

This is a very simple example. In an irregular area judgment must be used in valuing the measurements. In irregular underground excavations, cross-sections at intervals depending on the change of form of section must be used. These cross-sections would be taken with the level and staff, the staffman measuring the hight to the back, and calling it to the instrument man at each level point. With much of this work to do it would pay to have a special column marked, "hights to back," in the level book.

Measurement of Contents of Bins

In irregular box-like bins, never surcharged, the simplest method is to take a number of measurements at regular intervals from the top down to the surface of the material, and then average these depths (according to the method of averaging mentioned before). Knowing the whole depth of the bins, we can then get the average depth of ore. In bins with hoppered bottoms of various shapes, the same general method may be followed, if the capacity of the bin for each foot in depth is first calculated. Surcharged bins or bins in which the surface of the material or the bin bottom is very irregular, are best measured by plotting cross-sections, and taking out the areas in the usual way. Where bins of irregular, empty section have to be measured, it pays to have the sections of the empty bin plotted to scale in ink in a notebook of handmade paper. The surface of the contents of the bin may often then be simply sketched on the section in pencil, and rubbed out before the next measurement. Having the empty section already drawn saves a lot of time in the field.

Measurement of Dumps

To estimate the contents of a dump or pile of ore is frequently necessary. If the dump is of great area, and there are no records of the original surface levels, the estimate can only be approximate. In the case of large, flat-topped tailings dumps, in which the top area is not very different from the bottom area, and on fairly level ground, or ground of small uniform slope, an estimate may be made from a plan showing the edge and the toe. A series of levels should be taken around the toe, and another series to the same datum at intervals on top. The top of such a dump is generally fairly level, so that no particular care is needed in spacing the levels. The dump may then conveniently be divided into sections or divisions, the area of the top and of the bottom of each division taken, and the mean reduced level of the top and of the bottom found separately by averaging. By simply taking the mean of the top and bottom areas, and multiplying by the difference of the mean levels, we get an approximation, but for closer work the prismoidal formula should be used. Since the batter of a dump is usually uniform at any one place, even if part of the dump has been removed, the middle area may easily be found by drawing a line around the dump half way between the edge and the toe. If the dump lies on steep or irregular ground, the calculation should be made from cross-sections, taken at right angles to the top center line. The right angles may be laid out by optical square or pocket transit. The center line, of course, should be approximately the greatest length of the dump. As long as the cross-section keeps about the same value, 40- or 50-ft. intervals along this line on a big dump, together with the use of the mean area method, will be sufficient. At the ends the sections must be closer, and the prismoidal formula should be used. In settling this important question of the spacing of sections in any estimate, it must be constantly remembered that the prismoidal formula is mathematically correct, and the mean area method an approximation, for any solid with parallel ends, and capable of being generated by a right line moving on the boundaries of the end areas—in other words, for any prismoid.

Measurement of Long Heaps

In measuring long-shaped heaps of small section, such as heaps of coal or concentrates piled along railway lines for subsequent reloading, it is, however, impossible without the use of a multitude of sections to adhere closely to this rule. The sections can with practice be so placed at fairly long intervals—say, 30 or 40 ft.—that the material lying between them could be shoveled up into an approximate prismoid. In dumps of this sort, a close estimate can, of course, be made mechanically by spacing the sections at regular short intervals—5 or 10 ft., according to the regularity of the heap. This way, again, would mean a multitude of sections to take, plot and calculate, but this method must be followed for periodical measurements, if the area under the dump is very irregular. Bottom sections should be taken before the dump is formed, at, say, 10-ft. intervals, and plotted in ink, the sections of the dump itself being taken at the same points, and plotted in pencil on the bottom sections. When called upon to measure a dump on irregular ground, with no previous levels on record, a vivid imagination is exceedingly useful. A party of three men can very quickly estimate these long dumps—3000 or 4000 tons spread over ¼ mile of railway can be measured up in about four hours as far as the field work is concerned. A good system is this: The leader pegs out half a dozen sections, at the greatest intervals at which he can mentally shape all the material between them in prismoids, with the pegged sections as end areas. He then records the sections distances and offsets as they are taped and called out by the other two men, then leaves them to get the levels (with a dumpy, which is much quicker than any pocket level), and proceeds to peg out sections on another length of dump until the first lot of levels is completed. Where much of this work has to be done, it pays to have special books or sheets printed for recording field notes, thus:

Section.	Staff Reading.	Offset.	Remarks.

A complete set of notes can then be taken on one page of a book, or on half a sheet where the loose-leaf system of recording field notes is used. Each section is complete in itself, as where stuff has to be shoveled out of trucks and in again it will never be piled so high that all the levels cannot be taken off one set up. There is, therefore, no need to reduce the levels, but the section can be plotted direct off the line of sight of the instrument as datum line.

Measurement of Irregular Cones

In calculating the tonnage in irregular cones the best method is to make a contour map of it. A rough theodolite traverse should be run around the toe, and from each station bearings, vertical angles and slope distances taken to any changes of slope in the sides and to one point on top. Then find the reduced levels of the station points around the base, make a rough survey of the top off the point fixed by slope from the bottom survey, and take levels over the top reduced to this point as datum. Now plot the whole survey in plan, and figure on the reduced levels, calculated to the one datum, at all the points fixed. Contours at any desirable intervals may then be plotted by interpolation. The areas of the contours may then be taken out, and the volume calculated by either the mean area or the prismoidal formulas. In taking out all these irregular areas, a planimeter is almost a necessity, although tracing linen or paper ruled into small squares will do as a makeshift. A planimeter should be occasionally tested on a carefully plotted square of known size. Even on small areas of 1 or 2 sq.in. area, the planimeter will give results within about 1 or 2 per cent. Where sections are to be used only once, it pays to plot with a hard pencil, grooving the lines well in so as to facilitate guiding the point of the planimeter. Of course, where the top section is plotted on a permanent bottom section, and rubbed out so that the latter can be used again, a soft pencil is necessary.

Measurements of Excavations, Such As Quarries and Open Cuts

This is a branch of work in which I have had very little experience. The same general methods of plotting cross-sections and calculating the volume from their area would be followed, but the difficulty would lie in taking the sections across steep and irregular falls. I have raised the point in the hope of discussion.

In discussing the above paper, C. W. Matters suggested a useful method for measurements of open cuts. A center line is first pegged along the bottom of the quarry. A theodolite is then set upon the section points (at suitable intervals), and a right angle turned and the section marked out. For the bottom of the open cut the theodolite is used as a dumpy level, and offset distances and levels taken as usual. For the irregular sides vertical angles are taken, and slope distances to the points measured with a steel tape. The chainman takes a level staff with him. Where possible the angle and slope distance is read direct to the point on the side, but where hummocks of rock, etc., intervene to hide the actual point, the staff is held vertically on it, and the angle and slope distance read to a figure on the staff, which is recorded in a separate column.

H. Warlowe Davies considered that Mr. Matters' method would be slow, as leveling with a theodolite is not so quick as with a dumpy, and an optical square would be much quicker and quite accurate enough for marking off the sections at right angles. He preferred the use of a pocket level or clinometer to overcome difficulties in the side measurements. A parallel base line would also be necessary on top. Mr. Davies also discussed several other points, and advocated determining ore reserves off the floor plans, as being sections only 7 or 8 ft. apart, and suggested reading the staff inverted against the back as a safer method for measuring the hight to the back in underground excavations. He mentioned the following factors:

	Cu.Ft. per Ton.	
Coal	39.17	(careful measurement of a truck)
Coal	40	(usual practice
Friable ore in place	8.4	(from a square set)
Run-of-mine ore	16	
Slime	20	
Tails	18	
Fine jig tails	?	

In his reply to the discussion Mr. Donaldson said that the two methods of measuring open cuts seem to be suitable for two classes of excavation, Mr. Matters' (theodolite) method being adapted to deep, more or less V-shaped cuts, and Mr. Davies' to flat-bottomed quarries, in which the irregularities of the sides do not greatly affect the volume. He also thought Mr. Davies' suggestion for inverting the staff in measuring stopes, etc., was good. He also gave the following factors:

	Cu.Ft. per Ton.	
Ore in place	9.5	(from measurement of stopes or several levels with known extractions)
Coal	40	
Run-of-mine ore	16	
Tails	19	
Slime	19	

Indian Gold Mines

The gold production of the Kolar field, in Mysore, India, in February was 41,898 oz. bullion, the smallest in a long time. This was due chiefly to a fire, which stopped production in the Nundydroog mine for a time. The output for two months ended Feb. 28 was 89,807 oz. bullion in 1908, and 88,919 oz. in 1909; a decrease of 888 oz. The bullion reported this year was equal to $1,654,158, or 80,027 oz. fine gold. The report includes two mines—the Hutti-Nizam and the Dharwar Reefs—in the Deccan.

In drifts at the Van Dyk Proprietary mines (*South African Min. Journ.*, Jan. 9, 1909), the average advance for each face throughout the mine was in December, 217 feet per month. There were seven drifts, five driven double-shift and two single-shift.

Gold Dredging Ground in the Upper Amazon Valley*

The first mining concession granted by Peru for working the gold alluvials of the Inambari was confined to the torrential district and did not extend to the lower and far richer region. The gold here was discovered in connection with the india-rubber industry. The rubber men, while building a road down to and along the lower course of the Inambari as far as the head of navigation, discovered that natives and also their own rubber-pickers spent much of the time washing gold. Thus prompted, the English managers made experimental washings, and after professional assistance, an elaborately organized expedition was sent out from England, and more ground was examined with the same result. The gold from the Inambari resembles in form and quality the gold obtained from the Kaka. It is flat and relatively thick, having evidently been subjected to pressure after leaving its original vein. When a pan of gravel is washed the heavy residue containing the gold is a black sand. An analysis of a sample from the lower Inambari gives the following results:

	Per Cent.
Silica	8.50
Gold	0.27*
Silver	0.024†
Copper	0.55
Arsenic	0.50
Iron	37.10
Alumina	24.30
Titanic oxide	4.18
Manganese	1.50
Sulphur	1.57
Oxygen (by difference)	21.406

* 88.20 oz. per ton. † 7.84 oz. per ton.

Thus far all we know about the Incahuara and Inambari gravels is the result of exploratory expeditions; but companies are now proceeding to test these gravels by actual working, and their results will be watched with interest. All that the various experts have done is to ascertain surface richness. At Incahuara, however, the ground was explored to a depth of 16 ft., and found to be equally rich all the way down. At no place has bedrock been reached, because the water poured in when the river-level was reached. Neither has the bed of either river been examined.

Method of Working

Only one method of working these gravels is practicable, i.e., dredging; the ground does not fall steeply enough for sluicing or hydraulicking. At Incahuara, for instance, and along most of the reaches of the lower Inambari (except where torrential side streams enter it) there are no boulders. On neither river, again, is there hard clay; the ground is loose, a mere compound of stones and sand. Again, at Incahuara the bedrock is friable and easily scraped by the lip of the dredge buckets, and a similar bedrock appears on the Inambari.

The current of neither river at the points of interest to the gold dredger is swift enough to cause any danger to the vessel. In flood time it can float over and excavate the banks, or can be worked in a paddock. During low river it can delve up the bed of the stream.

The transport of dredges to these remote places is difficult and costly; but in the case of the Incahuara dredger a considerable part of the machine is said to have been already transported to the site. According to report, the Ollachea road presents no greater difficulties than does the Caravani.

Extent of the Deposit

The question that has to be answered is: What is the extent of these two dredging grounds? The answer can be only hypothetical. The only part of the ground on the Inambari or Beni rivers that has been examined by competent men is the Incahuara basin, which contains about 10,000,000 cu.yd. of dredgeable gravel. Its surface has nowhere yielded less than 19d. to the cubic yard, while large areas of it average at least a dollar, and many places very much more. The bedrock value is likely to be much higher.

An average value of 3s. per cubic yard is not an extravagant estimate. Of course, local authorities put the average very much higher. At this rate the Incahuara basin alone contains £1,500,000 worth of gold. For 100 miles below the Incahuara basin it is believed that the Beni gravels yield gold; there are numbers of places where it has been definitely located, so that in all probability the Incahuara basin is a mere fraction, probably not more than the hundredth part of the dredgeable ground on the Beni.

On the Inambari, if no spot has been so carefully examined as the Incahuara, a much longer stretch of the river has been rapidly sampled by more than one expert, and values as high, for instance, as 22s. to the cubic yard have been revealed. The Inambari, therefore, is likely to yield as much gold as the Beni. The lower tributaries of both rivers are margined by gold alluvials.

Lode Mines

Something is to be expected, too, from the substance of the hills through which these rivers flow. At a point situated between the basins of the Inambari and the Beni, one gold mine has been worked for some years by an American company. Its output of gold is known to have run to several millions of dollars. During his explorations of the province of Caupolican Doctor Evans observed many signs of old workings in the rocks bordering the Beni. It is unlikely, then, that dredging will be the beginning and end of the exploitation of this region.

As far as we now know, all the indications seem to point to the conclusion that this part of the eastern slope of the Cordillera is a real goldfield of great size and importance. Its southern limit seems to be somewhere about the latitude of Mount Illimani; but as to the limit of its northern extension we know nothing. It will probably be long before we have exact knowledge over so large an area, so difficult of access.

Dense tropical forests render prospecting extremely difficult; only along the river banks has it thus far been seriously attempted. The climate at the level we are considering (about 1000 ft. to 2000 ft. above sea) is healthy; once plantations have been cleared, roads made, and suitable houses built, people can live there in comfort all the year around. All that is needed is a flow of population in this direction; for it is probably the richest but least developed part of the world.

*From a paper by Sir Martin Conway, read before the Society of Arts, and published in the London *Min. Journ.*

Electric Motors in a Concentrating Plant

The concentrating plant at the Washoe smelter, Anaconda, Mont., was one of the first in the country to be driven by electric power exclusively, four large induction motors being used for this purpose. The concentration building is 600 ft. long, with the steam plant, heretofore used for driving it, located in the center. The jigs, tables, etc., are driven from a main line shaft 500 ft. long, to which the steam engines were connected by rope drive and friction clutch pulleys. The steam plant has been kept intact, to be used as a reserve in case that the electric power fails. The mill as a whole is divided into eight sections, four on each side of the engine room. Two induction motors are installed in each half of the mill, and connected to the main shaft by rope drive and friction clutch pulleys.

These large motors are notable because of their having squirrel-cage rotors, something unusual in motors of this size. Their guaranteed full-load efficiency is 91 per cent. and full-load power factor 92 per cent. Squirrel-cage motors were chosen because the starting conditions are favorable and the power factor of this kind of motor is higher than that of the wound-rotor type. The general construction of these large induction motors is practically the same as that of the smaller ones built by the Allis-Chalmers Company.

In addition to the four large motors and the 200-h.p. variable-speed induction motor for operating the pumps in the mill, the Allis-Chalmers Company also furnished for this plant three synchronous motor-generator sets of 300 kw. output each, and one small induction-motor generator set for starting and exciting the synchronous sets.

Skips or Buckets in Sinking Vertical Shafts?

Sinking with Buckets Is More Dangerous, and If Much Water Is Encountered, More Expensive, While Timbering Is Much More Difficult

BY CHARLES B. SANER*

Most vertical shafts on the Rand have been sunk by means of kibbles or buckets, with or without crossheads. All modern shafts on the Rand, South Africa, are rectangular; and until lately all the shafts were sunk with their long axes parallel to the strike of the formation, but now that the mines have become so deep that compound shafts are not economical, it has been found better to sink the shafts at the deeper-deep mines with their long axes in line with the dip, and at right angles to the strike.

In a number of instances hauling engines have been installed that cannot hoist from the extreme dip of the property in one lift, a grave error in design, so that the present amalgamation era will bring relief to many a mechanical engineer. Here I may be allowed to make a complaint, that those who design new plants, whether for surface or underground equipment, seldom take the trouble to consult those who have to work the plant; upon whom in the end the blame falls if things go wrong, but seldom the credit if all goes well.

Two methods are employed in sinking vertical shafts: machine drilling and hand drilling. Sometimes a combination of both methods is used.

Shaft Sinking by Means of Air Drills

On the Rand machine sinking has been proved less expeditious and more costly. The great drawbacks are the necessity for irregular working shifts, both for drilling and shoveling, and the raising and lowering of the gear that causes loss of valuable time. If the formation passed through is in any way disturbed, the heavier charged machine holes break wider and make the sides of the shaft bad and heavy while more timbers are broken than when the shaft is sunk by hand. If the cut does not come, the whole round is hung up; that means loss of time and added cost in blowing out the holes and reblasting.

At the Village Deep No. 2 shaft, as native labor was scarce immediately after the war, sinking was done by machines and shoveling by one gang of 20 whites and another of 26 natives. The best footage done was in October, 1904, when 150 ft. was sunk in 31 days, a world's record for machine sinking.

Twelve machines were used on four bars; the cut holes were drilled 9 to 10 ft. deep and the other holes 8 to 9 ft. deep. The details are: Number of rounds drilled in the month, 20; average number of holes per round, 32.5; average time drilled, 8.28 hours; average time cleaning out, 27.27 hours; average time per round, 37.40 hours; average depth sunk per round, 7.5 ft.; number of ton buckets of rock broken per round, 231.

The whole round was blasted together, and it took two shifts to clean out; a task of 80 buckets was set for the first shift, and the second shift cleaned up. The sockets of the holes were then blown free of dust with compressed air, and again charged and blasted, the first shift coming in again and completing the cleaning up. Two engines and buckets were used. The timber was usually lowered just before the drilling shift went down—10 wall plates, or five sets at a time; the filling-in was done during lashing.

This method is bad, as there are no allotted hours of work for the men; this generally resulted in a rush. But as far as could be seen, no better system could be devised, as it was no use blasting the round until every hole was drilled to the proper depth; one awkward hole delayed the whole shaft. The great job of loosening the bars and machines, raising the hoses and bringing everything to the surface, is an undertaking that operates against speed in machine sinking—not to mention the waste of labor which, in order to be available, at any time day or night must be paid for, but which half the time is unemployed.

Shaft Sinking by Hand Drilling

It has been stated that where very hard ground or water is met with, machines will replace hand labor; but I fail to see it. The hardest ground can be more cheaply and as effectively sunk through by hand as by machines.

In the Turf Mines shaft a very hard dike was passed through and a square shaft cut by hand. If machines had been used, the blasting of the large holes would have made a wide ugly shaft, necessitating extra timbering, and the hauling and shoveling of unnecessary rock. With hand labor excellent results have been and are being obtained. The shaft is cut almost to exact required size, regular shifts are employed, and greatly increased speed has resulted.

In the latest large seven-compartment shafts the method of procedure is somewhat as follows: Three 8-hour shifts were worked, consisting of from 75 to 85 boys, under the charge of a white sinker and an assistant. The rock broken by the previous shift is shoveled into buckets or skips, and then from 35 to 45 holes from 30 to 50 in. deep (according to the nature of the rock) are drilled, mostly double hand, and blasted in the eight hours.

The holes are usually put in at right angles to the dip of the formation (or even flatter). When the shaft is sunk with the dip, practically no sump is carried, but instead a sort of vertical stope face, with the benches well defined, the north and south ends being, as a rule, a little higher than the center. With the formation dipping 30 to 40 deg., as in the central Rand, most of the rock in blasting is hurled to the north or rise end of the shaft, so that shoveling is mostly at one end. This is a serious drawback, as rapidity of sinking depends upon the speed of getting out the broken rock. The more time there is to drill, the deeper the holes, and the better the footage.

Various forms of receptacle are used to clear out the débris from the shaft bottom—cages carrying one or more trucks, buckets and skips. Mention is only made of the first as an old, and, as far as the Rand is concerned, a disused system. The other two systems are used on the Rand, and have ardent advocates. I will endeavor to give the advantages and disadvantages of each, claiming that privilege, as I have had experience with both.

Although it may be presumption on my part to criticize well known experts, I may mention that all those who have sunk with both buckets and skips have no hesitation in their preference; while those who have only had experience with buckets, naturally pin their faith to that system, knowing little of the other. In the large shafts two engines are usually employed, and to the winding ropes are attached buckets or skips.

Sinking With Buckets

Buckets are made of iron or steel and have a capacity of 16 to 20 cu.ft.; they are usually oval or cylindrical in shape, about 4 ft. high, and attached to the rope by a ball-bearing swivel, to bale or bow, or by a chain of iron or steel, bent to form a loop in the middle or provided with a hole for attachment. Some buckets are hung just above the center of gravity, and are held in position by two fingers above the bucket, which are turned back when

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NOTE—Abstract of a paper in the *Journal* of the South African Association of Engineers for October, 1908.

dumping. Other buckets are hung by a chain, with a large link in the middle, attached to two lugs on the top of the bucket, and are tipped by inserting a hook in a ring at the bottom of the bucket and allowing the winding rope to lower slightly.

The bucket may also be tipped on inverted V-hinged doors, or into a swinging chute. Four or more buckets are always in use; the great secret is always to have two in the bottom being filled. Crossheads of various makes are used to keep the bucket from swinging too much in the shaft.

An empty bucket is lowered by the engineman to within 10 ft. of the bottom. and on the signal to lower, he does so slowly. The sinkers below seize the bucket and push it to the desired position most suitable for loading, and detach the rope at once. Meanwhile the bucket on the other rope of the same engine, which is at the surface, is tipped. The rope in the shaft bottom is then attached to a full bucket, and on the signal being given, is raised slowly about 5 ft., is steadied vertically below the rope by the shaftmen, and then sent away. The engineman slows up on taking the crosshead at the timbers, which are from 40 to 140 ft. above the bottom of the shaft, and then speeds up to surface. From the bottom of the timbers the bucket is free to revolve, and sometimes does at a great speed before engaging the crosshead.

The buckets being usually of small diameter the shovelers can crowd around for loading. When nothing but dry rock has to be handled the bucket is very adaptable; but if any quantity of water has to be baled as well, its drawbacks are soon manifested. The steadying at bottom and tipping at top cause serious delays. The carrying capacity is limited, and it cannot with advantage be made much larger. When lowering timber and boys, limited capacity of the bucket is again a serious drawback; and when taking timber out at the bottom set, it is dangerous on account of its swinging. Drills can be lowered to the bottom, and, by overturning the bucket, are at once deposited on the shaft bottom. Few repairs are necessary for upkeep. Small-diameter ropes can be used—a saving in cost.

Many more trips are required to lower and raise the boys and material and timber, 6 to 8 boys only being carried at once. A form of bucket used by me was oval in shape, only 3 ft. high and from 3 to 3 ft. 6 in. diameter. It was easy to shovel into this bucket, and because of its shape the bucket was not so liable to catch in the timbers; but it was not very safe for boys to ride in, as they might be jerked out.

In blasting with buckets, after the warning signal has been given, the driver raises the bucket a few feet and lowers again. He is liable to let out a little slack rope, and on account of the irregular bottom, especially in shafts cut with the dip, the bucket will not stand upright nor steady; when the "rightaway" signal is given, the engineer takes the bucket away too quickly. This causes swinging, and there is every chance of fouling the timbers. Because of this swinging, a bucket cannot safely be quite full.

It is difficult to examine and clean down the shaft timbers and sides, especially between the last set and the bottom of the shaft—the place from which most of the rocks that cause accidents slab off. As it is almost impossible to remove bad or loose ground from a swinging and revolving bucket, the slab is left, with the hope that it will hang there until the timber reaches it. When using buckets in timbering, several sets are usually hung at a time; this means a rush of work for the timbermen, and then a slack time. The timber being farther away is little damaged with blasting. In some shafts extra boys are stationed on the timbers to steady the ascending bucket before it takes the crosshead.

Sinking with Skips

Skips are rectangular boxes of steel or iron, supported on the bottom by a shafting on which the box revolves, and in a framework with shoes running on guides. These shoes, during sinking, are 18 to 35 ft. long; the skips are self-dumping, and have a capacity varying from 20 to 40 cu.ft. The following are the dimensions of a skip frequently used: Three ft. 8 in. by 3 ft. 8 in. by 3 ft. 6 in. high. The important point is to have the loading box low enough so that rock can be thrown in over a shoveler's head from anywhere in the shaft. In the large shafts the best arrangement is to have one engine running the two skips in Nos. 2 and 3 compartments, and the other engine to run in Nos. 5 and 6 compartments.

The native gang is divided into three parties so as to have a regular set of men in each of Nos. 1, 4 and 7 compartments. Each party is again divided into two shoveling and one picking units.

One skip comes to the bottom, and 12 to 14 boys immediately load it—5 on each side and one at each corner, throwing over his shoulder. Immediately the skip is full—and it can safely be filled quite full—it is rung away and the driver can pull away and gather up speed at once. Meanwhile the pickers loosen the rock while the other skip is descending. When the empty skip gets to the bottom timbers, the loaded skip is tipping automatically, and no time is lost. After tipping the skip is drawn farther up the headgear, there being 30 ft. of head room above the tip, while the other is lowered in the shaft bottom. Loading is begun at once.

The timber is kept 20 to 30 ft. away from the bottom; short, temporary, 6-ft. lengths of steel guides are put downward projecting 3 ft. below the last set of timber, so that there is never any chance of the skip's shoes coming out, thereby insuring perfect safety.

When six 6-ft. lengths are in, they are taken out in one lift of two 36-ft. guides, and the permanent steel guide, 30 ft. long, with a temporary 6-ft. length, fastened by fishplates to the lower end, so as to take any blows of rocks from blasting, is bolted securely in place.

To take out the two 36-ft. lengths and bolt the two permanent lengths in place takes only from half to one hour, and is done while the bottom is being drilled over; that is, between 12 and 2 midday. The holes in the dividers are drilled on the surface before the dividers are sent down, and the steel guides punched from measurements taken in the shaft.

One set is lowered at a time, and the system adopted is as follows: First thing in the morning the timbermen descend and, while the débris is being cleared up from the shaft bottom, block the set lowered and filled in the day previous; then when the boys are drilling and the engines are free, four half-wall plates are hung in pairs and filled in 1 to 1½ hours. The corners are temporarily blocked and the short guides bolted on. The sides and ends, between the two bottom sets, are carefully examined and all loose rock is taken down. Thus the shaft is being examined and trimmed down daily, and if there is any dangerous rock, the boys can easily be moved to one side by shouting, and the rock dislodged and sent to the bottom without any mishap or delay, it having no distance to fall. When the wall plates are being hung, the south skip of one engine and the north skip of the other engine (skips in 2 and 6 compartments) are filled with the end pieces, studdles and dividers, and with compartments 1, 4 and 7 staged over, the filling in of the set is soon done, for one more skip load, or three in all, completes the whole set. All this timber can be taken out of the skip easily and with comparative safety, as the skip does not swing.

Skips have to be periodically repaired, for the liners to shoes and other parts wear out. Large diameter ropes have to be used; there is greater safety with skips than with buckets; better and more work is done, and, given equal conditions, just as great speed can be made.

I may mention that at the Turf mines, while sinking with skips from a depth of from 640 ft. to 3007 ft., there has not been one blasting accident, and only two from falling rock, which came from faulty ground.

During drilling, the sides can be easily examined and loose rock can be removed with safety from the timbers. A skip can be well filled, and when the signal is given, it is at once hoisted to the tip, with no jar or trouble, and automatically emptied. If the rope winds badly on the drum, there is no danger to the skip as the shoes run-

ning on the guides prevent its swinging, and there is also regularity of work.

Greater loads can be handled at one time, and the capacity of the skip can be increased while that of the bucket is limited. If water is met with and has to be handled before pumps can be installed, buckets are out of it, whereas skips can easily handle a fairly large quantity.

At the Turf mines the shaft has been cleaned up, one set blocked, another lowered and filled in, two 36-ft. lengths of temporary steel guides taken out, and the permanent ones put in place in seven hours, and without delaying the sinking operations below.

Comparison of the Two Methods

Excellent work has been done with both buckets and skips, but up to the present, because of meeting the most favorable conditions, buckets have done the quicker sinking.

It is impossible to make comparisons between two separate shafts, just as it is impossible to compare two adjacent mines as to working costs, or profit per ton—so many factors affect the issues, such as dip of ground, hardness and stratification of rock passed through, quantity of water, dikes, etc. The following are the best performances with each appliance:

At Brakpan No. 2 shaft, 204 ft. were sunk in one month and an average of 161 ft. in 14 months; the dip of the formation was about 8 deg. This was done with buckets.

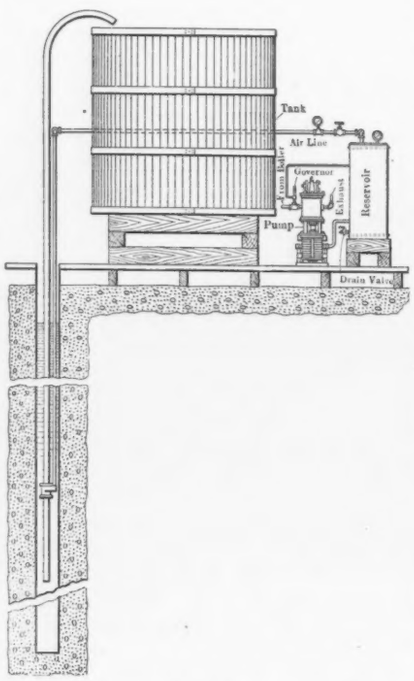
At Turf mines, 162 ft. were sunk in one month, and an average of 143 ft. in 14 months; the dip of the formation was from 32 to 44 deg. This includes one month when only 87 ft. were sunk owing to faulted ground necessitating stoppage for extra timbering. During the 14 months four dikes, totaling 98 ft., were passed through. This was with skips.

In examining the published statistics of accidents, the following figures are significant: From 1903 to 1907 there were 15 fatal and 15 nonfatal accidents due to the swinging of the bucket. From July 1, 1903, to Dec. 31, 1906, accidents due to the swinging of the bucket or the crossheads catching, men standing on edge, or rock falling out of the bucket or skip were, with buckets, 57; with skips, 8. Between 1902 and 1908 the number of accidents, including falls of rock from shaft sides, or out of tip (excluding blasting accidents) were, with buckets, 97; with skips, 23. Unfortunately I have been unable to get the exact footage sunk by each method during that period.

In reading the evidence given before the Rope and Safety Catch Commission, one is struck by the diversity of opinion expressed by the advocates of each system, but one notices that those who have used both buckets and skips are almost all in favor of the latter, and to that opinion I most strongly adhere.

Raising Liquids by Compressed Air

The use of compressed air in pumping, especially from deep wells, is increasing on account of the simplicity of the system and the low cost of maintenance. In this method there are no moving parts; the only requirement is that the size, length and connections are properly designed so as to obtain maximum efficiency. Still, while pumping by compressed air is simple, the problem is better solved by tests than by mathematical calculations. The Westinghouse Air Brake Company, of Pittsburg, has lately completed a series of



WESTINGHOUSE AIR-PUMPING INSTALLATION

nearly 2000 tests covering a range of from 350 to 400 different conditions in deep-well pumping in order to obtain data concerning the amount of water delivered, air consumed, and the best proportions for and arrangement of piping and apparatus. The accompanying illustration shows the system as frequently installed by that company.

The council of the chamber of mines of Victoria has passed a resolution emphatically protesting against the "very lenient and inadequate sentences" given by magistrates in many cases of convictions under the Gold-buyers Act. Members expressed the opinion that the crime of gold stealing will never be checked while lenient sentences are given. In recent cases fines of £1 and £2 10s. have been assessed for offenses against the act—amounts which the council considers altogether inadequate.

The London Silver Movement

The imports and exports of silver in Great Britain are a matter of much importance, since London still remains the great silver market of the world, and by its fluctuations the prices and movements of silver are largely governed. The totals of this movement have been given heretofore; in the following tables the details are stated, as they are reported in the annual statement of Messrs. Pixley & Abell. According to this statement the imports of silver into London for two years are valued as below:

From:	1907.	1908.	Changes.
United States...	£11,961,701	£ 8,305,976	D. £3,655,725
Canada.....	129	240,532	I. 240,403
Mexico and S. America.....	255,515	211,267	D. 44,248
Australasia.....	125,944	120,241	D. 5,703
Africa	64,017	196,469	I. 132,452
India.....	1,218,473	271,000	D. 947,473
China.....	377,485	.....	D. 377,485
The Straits.....	958,148	46,666	D. 911,482
European countries.....	997,138	924,713	D. 72,425
Other countries.	25,342	10,025	D. 15,317
Total.....	£15,983,892	£10,326,889	D. £5,657,003
Approx. ounces.	55,660,500	46,883,600	D. 8,776,900

The total imports do not include silver in ores, which was valued at £2,244,930 in 1907, and £2,148,680 in 1908; raising the approximate quantities imported to 63,898,000 oz. and 56,639,000 oz. in the respective years. The decrease in values was much less than that in quantities, owing to the lower average price of silver in 1908. It must be remembered that a considerable part of the imports credited to the United States is derived primarily from Mexico, and a smaller portion from Canada; this silver being smelted or refined in this country from ores and base bullion from those countries. The British returns, of course, are based on the port of last shipment.

The exports for two years are reported as follows:

To:	1907.	1908.	Changes.
India.....	£11,163,424	£ 8,836,820	D. £2,326,604
The Straits.....	1,029,356	584,848	D. 444,508
China	559,450	822,300	I. 262,850
Total.....	£12,752,230	£10,243,968	D. £2,508,262
Africa, inc. Egypt	1,057,252	281,890	D. 775,362
Australasia.....	372,130	163,750	D. 208,380
United States...	660	200,598	I. 199,938
Canada.....	135,298	25	D. 135,273
Mexico and S. America.....	479,610	354,246	D. 125,364
European countries.....	2,098,659	1,925,677	D. 172,982
Other countries.	25,010	113,734	I. 88,724
Total.....	£16,920,849	£13,283,888	D. £3,636,961
Approx. ounces.	62,164,000	60,308,000	D. 1,856,000

While the decrease in values was 21.5 per cent., that in quantities was only 3 per cent.; this difference being due to the lower price of the metal in 1908. The causes for the decline in values have heretofore been explained.

In New Zealand applications for assistance in prospecting operations are presented to the local governing body, or a miners' association, which body may make a recommendation to the minister.

Electrically Operated Coke-squeezing Machines

By Alfred Gradenwitz*

The use of electricity in connection with mining and metallurgy has brought about a revolution in these branches of engineering work; electric operation has been adopted everywhere, not only in connection with the main work, preferably to other methods, but also with accessory operations, owing to the small space requirements and high safety characteristic of the electro-motor. This power is also used to facilitate handling, as is shown by electrical controlling apparatus in connection with all kinds of lifting and charging machinery.

Electro-motors have thus found an interesting scope in connection with the operation of coke-squeezing machines, as is illustrated by the accompanying photographs.

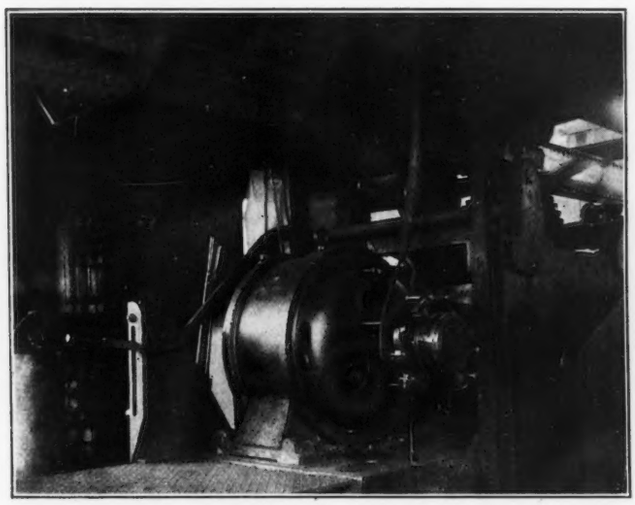


FIG. 1. INSIDE VIEW OF ELECTRICALLY OPERATED COKE-SQUEEZING MACHINE

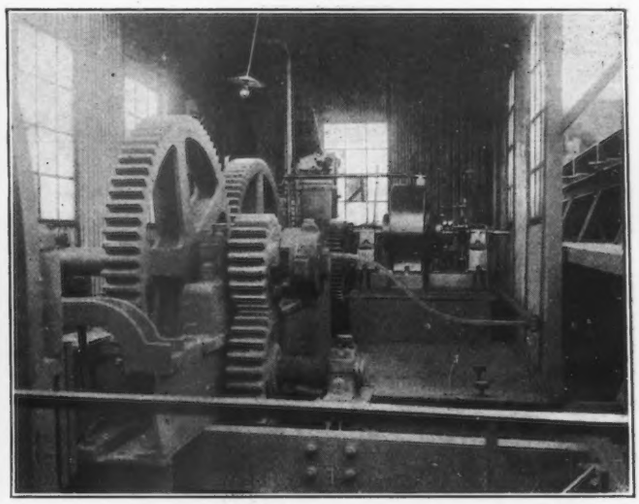


FIG. 2. INSIDE VIEW OF COKE-SQUEEZING MACHINE IN "PRINZREGENT" MINE NEAR BOCHUM

Operation of the Machines

Coke-squeezing machines are transportable devices serving to squeeze the ready-made coke out of the retort by means of a stamp. Four operations would have to be performed in this connection; first, right-hand traveling of the machine; second, left-hand traveling of the machine; third, introduction of the stamp into the retort; and, fourth, withdrawing of the stamp from the latter. An essential requirement of this kind of machinery is that the traveling motion and the operation of the stamp should never be carried out simultaneously; therefore, the operation generally requires only one reversible motor, starting from its position of rest under full load, and being connected by a clutch, as the case may be, to the traveling gear or the driving gear of the stamp. In some special cases, however, other equipments, including two motors, are preferred, one motor being used in actuating the stamp.

Fig. 3 shows an outside view and the electric drive of a coke-squeezing machine used in the Prinzregent mine, near Bochum. As in most plants of this kind, the coke ovens have been constructed with a view to arranging the several compartments like batteries, in long rows, one beside the other. Each of the compartments is about 2 m. in hight, 6 m. in depth and 7 m. in width; at either end there is a door, enabling the coke cake, formed from the mineral coal, to be removed with the aid of a long stamp.

The coke-squeezing machine is installed on a fairly heavy truck, running on six wheels, and carrying the driving gear with a movable stamp. The latter comprises a substantial iron shield of about the cross-section of an oven, and which is carried by a long rack, running on long rollers and being moved in a horizontal direction by gearing. The driving mechanism consists of a 45-h.p. direct-current Lahmeyer motor, running at a speed of about 1000 r.p.m., under a tension of 220 volts, and operating the rack through a multiple-toothed wheel gearing. In order to allow the ovens to be discharged successively, the whole machine can be made to travel on rails in a direction parallel to the ovens. The same motor which is used in moving the stamp, also serves for driving the truck, to which effect it is switched over by means of a clutch to the driving gear of the truck.

A Universal controller is used in steering the motor, all operations being controlled by the same apparatus. An armature short-circuit brake serves to instantaneously stop the motor.

Current is supplied to the motor in a way similar to tramway motors, by trolleys, fixed, as seen from the figure, to a framework pole. In order to protect this against atmospheric influences, the truck of the coke-squeezing machine is covered by an undulated sheet cabin.

Alternating Current at 1000 Volts is Used

Fig. 4 shows the drive of a coke-squeezing machine of the mine Rheinpreussen, near Homburg, where alternating-current at 1000 volts is used. A 30-h.p. alternating-current motor is designed with pole-switching for two different numbers of turns. As seen from the figure, a double controller and two stator oil-switches have been provided for steering the machine. The rack is moved in the direction corresponding to the coke-squeezing operation, at a lower speed, agreeing with the smaller number of revolutions of the motor, and in withdrawing the stamp, at higher speed.

In both of the plants above described, the same motor is used in actuating the squeezing machine, and in effecting the traveling motion of the whole system, by the aid of a mechanism operated with the hand lever visible in the figure.

In the department set apart for the working of by-products at the works of the Eschweiler Mining Association, two coke-squeezing machines have been equipped with Lahmeyer motors; with each of which there is used a 40-h.p. motor running at 750 r.p.m. under a tension of 500 volts. Fig. 1 shows one of these drives, the motor operating both the machine-traveling gear, squeezing stamp and planing rod. After the traveling gear has been thrown out by the aid of a hand lever, the two latter are likewise moved with a hand lever until a tooth of the rack engages with a toothed wheel arranged below the same, when the rod is moved on by the motor-actuated gear.

In Fig. 5 are seen two coke-squeezing machines, installed for electrical operation

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in the Röchling Iron and Steel Works at Voelklingen. Each of these machines comprises an alternating-current motor, which effects the motion of the squeezing rod, and after causing a wheel gearing to engage, also causes the traveling motion. The output of each motor is 30 h.p. at 1000 r.p.m., at 400 volts tension, and 15 h.p. at 500 r.p.m., the low number of turns being required in coke-squeezing and in moving the pressure rod. and the high speed, in withdrawing the rod.

Fig. 6 finally shows the drive of a coke-squeezing machine, a distinctive feature of which is the fact that special motors are used in operating the traveling gear and squeezing stamp respectively. The two 4-pole direct-current motors, in addition to the starting and controlling apparatus, have been constructed by the Lahmeyer company for an iron and steel works in Upper Silesia.

Coal-mine Legislation in Kansas

The new Kansas legislation forbidding the use of explosives in coal mines became a law last week. The new law provides:

"Section 1. It shall be unlawful for any person or persons engaged in coal mining to use or cause to be used dynamite, or other detonating explosives in the preparation of any blast or shot in any coal mine within the State of Kansas; provided, however, that dynamite or other detonating explosives may be used under such rules and regulations as may be agreed upon between the employer and the employees, same to be approved by the State mine inspector. All rules, regulations and permits to use dynamite or other detonating explosives as herein provided, shall be in writing.

"Section 2. It shall be unlawful for any person, firm, or company to direct any of its or their employees to go into any sinking shaft or development work in a coal mine, after shots have been discharged in which dynamite or other detonating explosives have been used, before having removed all smoke, gases or other unsanitary conditions that may have been created by the use of dynamite or other detonating explosives.

"Section 3. Any person violating the provisions of section one of this act, shall be deemed guilty of a misdemeanor and upon conviction shall be fined in any sum not exceeding twenty-five dollars.

"Section 4. Any person or corporation violating the provisions of section two of this act shall be deemed guilty of a misdemeanor and upon conviction shall be fined in a sum not exceeding one hundred dollars."

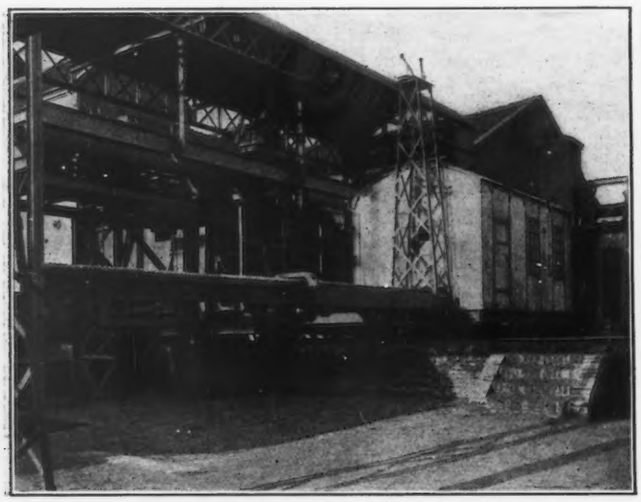


FIG. 3. OUTSIDE VIEW OF COKE-SQUEEZING MACHINE AT THE PRINZREGENT MINE

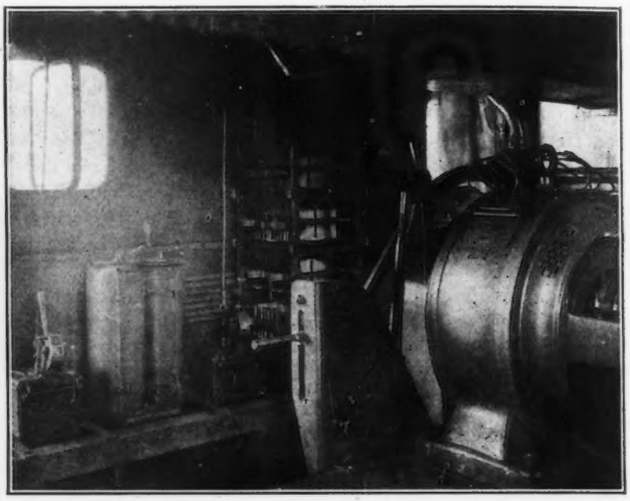


FIG. 4. DRIVE OF COKE-SQUEEZING MACHINE AT RHEINPREUSSEN MINE NEAR HOMBURG

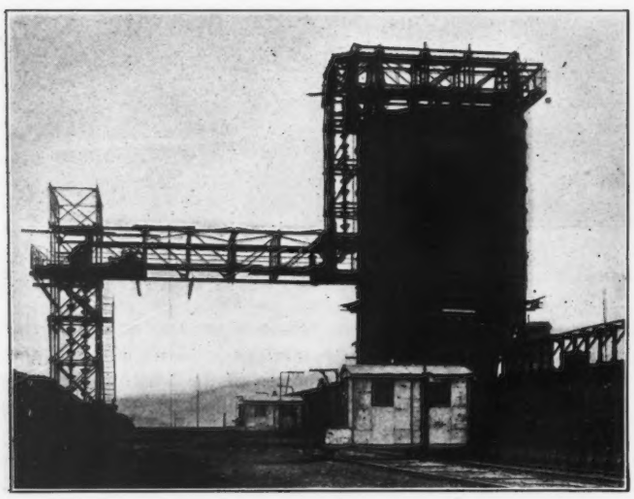


FIG. 5. COKE-SQUEEZING MACHINE OF THE RÖCHLING IRON AND STEEL WORKS AT VOELKLINGEN

FIG. 6. INTERIOR OF MACHINE SHOWING ARRANGEMENT OF THE MACHINERY

Coal Cutting by Machinery in England

By J. Hinton*

American readers may be interested in the following notes, which express the opinions of English mining experts on the subject of coal cutting by machinery. During the last 10 years or so, the question of coal cutting by machinery has commanded a considerable amount of attention in Europe, and English mining engineers have been more disposed to examine the economic advantages, which are claimed to result from the employment of coal-cutting appliances.

It has been found that when the coal seams and other conditions are favorable, the output per man may be doubled when machines are used, while the cost of production is appreciably reduced and an increased value of output per ton is obtained. In specific cases the cost per ton has been 42c. where hand labor had cost 60c.; the output per man being 4 1/5 tons as compared with 2½ tons. The proportion of round coal with machines, has also been raised 25 per cent. and greater safety has been insured to the miner.

Machines Afford Greater Safety

At one English colliery there was a serious accident when the work was done by hand for every 77,000 tons of coal mined; the proportion when machines were introduced was only one serious accident for every 450,000 tons produced.

It must be confessed, however, that in some seams machines have proved unsatisfactory; this is the case in what may be called the South Wales area, embracing the Cardiff and Swansea districts. The united coal output of these districts is not much short of 50,000,000 tons per annum, but the amount won by machinery last year was only 105,000 tons, the number of coal-cutters in use being only thirty. Two of the probable reasons for machines not finding favor in the South Wales area are that comparatively little holing is required, while the roads are of such a nature that close propping is absolutely necessary for safety. It is not likely that there will be any increase in the employment of cutters where the coal seams are thick, and lines of cleavage occur with regularity, so that there is not much labor required in working the coal.

Some statistics for 1906 and comparisons with former years will show what progress has been actually made in the introduction of coal-cutting machinery into English mines. In 1906, coal was raised from 3295 mines in Great Britain as compared with 3461 in 1902; the number of machines at work during 1906, was 1136, which compares with 483 in 1902, an addition of 653 cutters. From this it will be apparent that except in South Wales, machines are rapidly growing in favor, a considerable proportion of the increase occurring in the East and West of Scotland, Yorkshire, the Midlands and Durham.

Electric Power vs. Compressed Air

The driving or motive power, continues to be a debatable point. In Scotland, electricity is chiefly in favor, 171 machines being driven by it; 134 are driven by compressed air. Electric power has grown in favor most rapidly. On the other hand on the Newcastle, Durham districts compressed air is used for 140 machines, while only 79 are driven by electricity. In Yorkshire the proportion is 158 to 94, and in Lancashire 146 are driven by compressed air and only 14 by electricity.

The total coal production of the United Kingdom in 1906 was over 251 million tons; in 1902 the output was about 227 million tons. Of this production, the machine-mined coal in 1906, was 10,202,000 and in 1902, only 4,161,000 tons. A simple calculation shows though the experimental stage has been passed, the production per coal-cutter has only increased from 8615 to 8981 tons. The increase in the number of machines and the total output from them is, therefore, more significant than the amount of coal obtained by each machine, the reason probably being that a great many machines were started too late in 1906 to appreciably affect the output. A broader view of the question of coal cutting is now being taken; the miners do not now object to the use of the machines as they did some ten years ago; in 1902 only one ton in fifty was machine mined, while in 1906 the proportion was one in 25.

Many experts are of the opinion that coal-cutters are of considerable value in thin seams. It is the experience of many English authorities on coal mining that if the mining and hauling price in a seam worked, is less than 60c. per ton, a cutting machine would hardly effect an important economy. This probably explains why in the Midland districts of England, where 33¼ million tons of coal are annually obtained, there are only 140 cutters, while there are about 176 cutters in the east of Scotland, where the total output is not much in excess of 19 million tons.

Danger is feared from electrically driven machines in fiery or gassy seams. Some engineers suggest that in fiery mines, suitable air compressors should be erected and driven by electric motors, duly incased and placed in main intakes at safe distances from the face, and that the coal-cutters should be driven by compressed air from them. This method would be a practical and useful adaptation of electricity to the present method of working by compressed air, thus avoiding the serious risk which would be incurred by carrying the currents to the faces.

The advantages of coal cutting have been summed up as follows: An increased percentage of large coal is obtained, and the coal mined is in a firmer and better condition; a more regular line of face is obtained leading to more regular and systematic timbering; increased safety conditions for the workers; thin seams can be profitably worked; less small is made than in holing by hand; increased output and greater regularity; facility of supervision. Fewer explosives are required for getting down the coal and in some cases none.

*87, Atlantic Chambers, Manchester, Eng.

The Cost of Diamond Drilling for Coal in Pennsylvania

By E. E. White*

The following notes on progress and cost of drilling in the coal measures of Greene county, Penn., were taken from April 20, to July 13, 1908. I was on the ground practically all of the time, representing the company who had optioned the coal, and so had a chance to obtain correct figures on the progress of drilling. The costs are not as accurate, but are essentially correct.

The cost of superintendence and carbons is estimated. The superintendent, C. C. Hoover, of the Birdsboro Steel Foundry and Machine Company, which concern took the contract for drilling, was on the ground only one day. As he was looking after about half a dozen other drills, the estimated cost for superintendence is liberal. The cost for carbons would have been much less but for the fact that 2¼ carats were broken at a depth of 21 ft. in the first hole, probably by a piece of steel in the hole. This bore was abandoned and another started 2 ft. away.

The drill only worked a day shift, and was run by two men, the drillman, H. N. Wighaman, and a fireman. Bits were set in the company's shop, not in the field. The hours in the progress table refer to the drill, that is, to two men, except in the case of hours setting bits.

The drill had a hydraulic feed and a double-core barrel, taking a 2½-in. core. This type was described by W. F. Murray in the Journal of Feb. 23, 1907, and by the Sullivan Machinery Company, in *Mines and Minerals* for October, 1906. The outfit, with one good diamond bit, is furnished by the Birdsboro Steel Foundry and Machine Company, of Birdsboro, Penn., for about $3500.

Boiler and Pump Trouble

Considerable trouble was experienced with the boiler on the first two holes, which was accountable for a large part of the hours' delay on these holes, shown by the progress table. The boiler was of the upright type, set behind the machine on the heavy wagon frame. There were

*Carterville, Missouri.

no stay bolts, and the flues frequently had to be rolled every three or four days after the first week, and finally were rolled every day for three days in succession. After stay bolts were put in, the flues were not rolled again on the job. Except for the boiler and a troublesome donkey pump which supplied the water tank, the outfit was excellent. The delay on the last hole was mostly waiting for water, which had to be pumped a little over a quarter of a mile.

The expense of pumping on the last hole is not included, as it was borne by the owners of the coal. The contract read that water should be furnished within 100 ft. of each hole. The cost of moving on and off the ground is not included, as it would be variable, according to the distance and means of transportation. The distance moved between holes averaged about a mile by road. It was open country with good roads, so that moving was not expensive.

The core obtained was practically complete, both of rock and coal. The surface was from 6 to 19 ft. deep, averaging 9 ft. 9 in. It was clay, with no boulders, and was drilled out with a mud bit.

The table showing rates of drilling in different kinds of rock is the average of many observations on the five holes. The rate is, of course, dependent largely upon the drillman and how much pressure he cares to put upon the bit.

Both cost and progress tables are from the time the drill reached the ground until ready to leave:

RATE OF BORING.

Kind of Rock.	Ft. per Hour Actual Cutting.
Shale	7.05
Fireclay	7.10
Limestone	7.20
Sandstone	9.35
Coal	15.15

COST TABLE.

	Cost.	Cost per Ft.
Drillman	$307.70	$0.169
Fireman	192.31	0.106
Blank bits	5.00	0.003
Setting bits	10.00	0.005
Carbons (4¼ carats at $90)	382.50	0.210
Fuel (1050 bu. coal)	67.17	0.037
Oil and waste	11.00	0.006
Repairs	24.85	0.014
Moving	36.00	0.020
Superintendence	200.00	0.110
Total working cost	$1236.53	$0.680
Depreciation of outfit (20 per cent. on $2000 for 3 mos.*)	100.00	0.055
Total costs exclusive of freight and hauling on drill and wages and expenses of drillmen to and from Greene county	$1336.53	$0.735

* The outfit exclusive of the bit is worth about $2000.

PROGRESS TABLE.

	Hole No. 1.	Hole No. 2.	Hole No. 3.	Hole No. 4.	Hole No. 5.	Totals and Averages.
Feet drilled	377.5	358.0	279.4	236.4	568.7	1820.0
Hours actual cutting	54.44	40.00	35.07	27.45	75.90	232.86
Hours pulling core, lowering rods, etc.	38.81	31.00	23.43	18.30	60.85	172.39
Hours drilling	93.25	71.00	58.50	45.75	136.75	405.25
Hours delay, steaming, repairs	66.50	62.25	11.75	18.75	63.00	222.25
Hours tearing down, moving, setting up	20.00	30.00	25.00	20.00	46.75	141.75
Total hours	179.75	163.25	95.25	84.50	246.50	769.25
Hours setting bits	8	4	4	0	4	20
Feet per 10 hr. shift after setting up*	23.60	31.58†	39.83	40.83	28.50	29.97†
Feet per drilling hour*	4.05	5.05	4.75	5.15	4.15	4.49
Feet per hour actual cutting*	6.94	8.95	7.95	8.62	7.50	7.82

† Excludes 20 hours putting stay bolts in boiler.
* Excludes hours setting bits.

BITS USED.

	Distance Drilled.	Estimated Carbon Wear.
Mud-bit	48 ft. 7 in.	
Diamond bit No. 1 (carbons broken by steel?)		2¼ carats
Diamond bit No. 2 (hole No. 1)	369 ft. 8 in.	½ carats
Diamond bit No. 3 (hole No. 2)	339 ft. 0 in.	½ carats
Diamond bit No. 4 (holes Nos. 3, 4)	500 ft. 1 in.	½ carats
Diamond bit No. 5 (hole No. 5)	562 ft. 8 in.	½ carats
	1820 ft. 0 in.	4¼ carats.

Mr. Hoover, of the Birdsboro Steel Foundry and Machine Company, makes the total cost $1.13 per foot, but I think that figure must be rather high. Four holes put down by the same company in Raleigh county, West Virginia, are said to have cost $2.90 per foot.

Ankylostomiasis

SPECIAL CORRESPONDENCE

Professor Gréhant, of the Academie de Médecine in Paris, has been reporting the result of the studies he was entrusted with by the Ministre de l'Instruction Publique on ankylostomiasis. This disease is due to the presence of a worm inside the intestinal tube. The larvæ enters the system either by the mouth or through the skin and makes its way to the duodenum where it settles. The eggs only develop in the open air, when eliminated from the system, on the soil of the mine galleries at a temperature between 20 and 30 deg. C. Thus one man who is infected, can contaminate many fellow workers. In many mining centers, such as Anzin, Mons, Liège, every man undergoes a medical examination before being engaged. The diagnosis of ankylostomiasis is obtained by means of a microscope of 400 diameter magnifying power. The most effective cure for this disorder seems to be a mixture of etherized extract of male fern and castor oil, taken in pills or by spoonfuls for about a week.

Thanks to the precautions that have now been taken for some time, the disorder has notably decreased, but Professor Grehant doubts its ever disappearing entirely owing to the tenacity and extreme mobility of the larvae.

Temporary Fire Walls for Coal Mines

Near Saarbrück, in Rhenish Prussia about 40 miles in a southeasterly direction from Treves on the Saar, a unique type of temporary barrier is used for inclosing burning portions of coal mines. By this system a speedy shutting off of all air supply is accomplished which is the first necessity in dealing with underground fires.

The Prussian method is peculiar in the material used for building the temporary fire-walls. It is hay, compressed in the form of blocks. The material is so light that two men can, in half an hour, erect a tight wall across an ordinary entry, and furthermore, the wall will be air tight.

This is accomplished simply by filling up the cracks between the blocks with loose hay and then sprinkling the wall with water. The water causes the blocks to swell so that a perfectly air-tight barrier is made shutting off all air supply, through the entry, to the fire. Behind the temporary wall a more permanent wall may be erected if the conditions warrant. In case of overpowering gases or smoke, the miners wear a smoke hood to enable them to breath as they are erecting the partition. In commenting, *Der Bergbau*, Feb. 25, 1909, says this scheme has proved highly successful at the mines where it has been tried.

At the Komata Reefs mine, New Zealand, where the Brown (Pachuca) agitation tank was originally, and is still, used, the ore is crushed by 20 stamps through 4-mesh screens, and fine-ground in two 16x4-ft. tube mills so that 60 per cent. of the pulp will pass through a 200-mesh screen. The pulp is separated into sand and slime. The slime is agitated in high tanks, while the sand is treated by percolation. The extraction on the gold is 93 per cent. and on the silver 83 per cent. The value of the ore treated is about $8.75 per ton.

Notes on Tin Ore Dressing at South Crofty

At the meeting of the Institution of Mining and Metallurgy held at London in November, 1908, H. W. Hutchin described an instructive set of investigations on tin-ore dressing performed at the South Crofty mine, Cornwall, England. The work covers in particular the preparation of concentrates for the calciner.

The plant at the South Crofty, recently enlarged, now has forty 1050-lb. stamps and a Cornish battery of 30 heads, operated under a 7½-in. drop and at the rate of 102 drops per minute. All the machinery is electrically driven, everything being controlled from one board in the motor house. There are four 30-h.p. motors, one driving each section of 10 stamps. The cam shaft is so arranged that only five stamps need be hung up at a time when repairs are necessary. The 40 new stamps give a capacity of 3500 tons per month.

In the new part of the mill the pulp flows from the stamp battery to Lührig patent classifiers which deliver four sizes of product all carrying more or less slime. The firsts pass directly to six Buss tables, producing tailings, middlings and concentrates, the seconds and thirds to 16 Frue vanners and the fourths partially to each. There are also three barrel pulverizers driven from overhead shafting by a 20-h.p. motor. Frues and Buss tables are driven by two 20-h.p. motors. This scheme of treatment gives a cost of milling and dressing of 33.6c. per ton.

The ore treated is of a complex nature with an average value of 25 lb. of tin and 12 lb. wolframite per ton, 0.25 per cent. metallic copper, and 1.5 per cent. arsenic, in a gangue of quartz, feldspar, mica, tourmaline, chlorite and fluorspar. The accompanying table of determinations of concentrates gives an idea of the nature of the ore.

Nature of Concentrates.	Insol.	SnO_2.	Wolframite.	Copper Pyrites	Mispickel.
1. Firsts	46.1	7.08	3.48	2.89	11.4
2. Seconds	46.22	4.61	2.92	2.89	8.3
3. Thirds	46.85	4.74	3.33	3.03	7.25
4. Slimes	42.39	5.18	3.93	2.75	11.03
5. Firsts	26.47	10.87	5.00	1.87	24.5

The first four in this table are concentrates from development stuff, the last one from stoping ore.

The Samples

For the systematic investigation of the battery tailings only tin was determined and reported as pounds of cassiterite per ton. The assays were all made by reduction with zinc vapor after the improved method of J. J. Beringer, of the Camborne School of Mines. Dip samples were taken from the tables and from the joint tailings of the mill. These tailings were deposited in a series of ponds so that check samples of the accumulated tails could be taken.

Three samples were taken from the stream carrying the joint tailings from the battery. The first, in which water and sediment were allowed to run into the overflow from the bucket, thus saving practically only sand, gave an assay of 2.5 lb. per ton. The second, where overflow was avoided assayed 7.9 lb. per ton, and the third, taken in the same manner, gave a value of 6 lb. per ton. In this case a screening test was made with a 60-mesh sieve, that which passed through being separated into fine sand and slime by decantion. The results are given in the accompanying table.

Product Assayed.	Per Cent. by Weight.	Assay, Lb. Per Ton.
Coarse sand	28.1	2.8
Fine sand	34.3	5.0
Slime	37.5	9.83

Calculating the total value from the parts gave an assay of 6.2 lb. per ton.

At this point in his investigations Mr. Hutchin realized that supplementary tests were necessary to ascertain the relative proportions of fixed tin to tin in free grains. Considering ultimate recovery, he saw that it was essential to know whether the whole, or, if not, what portion of the cassiterite was present, as (1) detached particles, (2) as adherent to the original gangue. One enters as a factor of crushing, the other as a factor of the ore dressing. With this in mind the Buss tailings were first investigated with the stamps crushing through 25-mesh screens. The results were as follows:

	No. 1 Table.	No. 2 Table.	No. 3 Table.
Tailings	6.0 lb.	5.0 lb.	2.8 lb.
Middlings	4.4 lb.	3.1 lb.	3.1 lb.

From screening tests of the first two these results were obtained:

	No. 1 Tailings.	No. 1 Middlings.	No. 2 Tailings.	No. 2 Middlings.	No. 3 Tailings.
Coarse.	3.1	3.4	2.85	2.8	1.2
Fine	4.75	4.5	4.1	4.1	1.9
Slime.	10.1	No slime.	10.6	No slime.	13.0

These results showed that the "coarse" fraction from No. 2 middlings (assay value 2.8) showed no evidence of the presence of grains of free cassiterite, while in the case of the "fine" fraction there was decided concentration presumably of free cassiterite. Of the 4.1 lb., assay value, 2.5 lb. was free for recovery by concentration, while 1.6 lb. was locked up in the gangue so as to require finer crushing.

The results of a test of Frue vanner tails show the proportion of slime to sand to be 4 to 1, and give the assay value of the whole calculated from the fractions as 9.2 lb. These tests were so satisfactory that further work on the same line was followed out using samples of the tailings in bulk obtained from settling ponds.

Screen Opening

Another point tested was the most advisable size of screen opening. Magnetic separation to reduce the amount of fine wolframite had been decided upon, so coarser crushing was tried using a 20-mesh instead of a 25-mesh screen. This gave results which at first seemed inconclusive, but pointed toward the idea that one size of mesh would give about the same results as the other. After considerable experimenting it appeared clearly that under normal conditions the change from 25- to 20-mesh battery screens was not accompanied by any appreciable increase in the loss as far as the bulk of the tailings was concerned, while the coarser crushing reduced the amount of slime and aided magnetic separation.

The work of the pulverizers and the conditions in working the coarse sands rejected from dressing the burnt concentrates on buddles called "burnt leavings," were next investigated. By treating some of these burnt leavings on a Buss table it was at once apparent that considerable tin was present as separate grains for the table gave concentrates assaying 6.6 per cent. cassiterite with middlings running only 1.7 per cent. This tin was, however, low in value on account of adherent particles of iron oxide. The pulverizers with their combined scouring and flouring action tended to make this tin available.

At first the burnt screenings were screened and vanned, but as previously vanning with rich tailings had been unsatisfactory another method was adopted. Sonstadt's solution of mercuric-potassium iodide of a specific gravity of 2.82 was used to separate the heavy constitutents from the light, so that the nature of each could be investigated. In general this method is not as accurate as the vanning method and is besides more expensive. However, it is useful in cases where vanning is inapplicable and for a check method. In this case it certainly proved most useful. Ten grams of the coarse portion of the burnt leavings were cleaned of iron oxide with cold hydrochloric acid, washed and dried. This gave 6.562 grams cleaned product of which 1.524 grams were heavy and 5.04 grams light. The heavy assayed 723 lb. cassiterite per ton, the light only 5 lb. The fact that 15 per cent. of the material carried 723 lb. per ton is suggestive of the function of the pulverizers.

Slimes and Hight of Discharge

Next in order to cut down the proportion of slimes the hight of discharge in the stamp batteries was reduced from 7 to 3 in., and 20-mesh screens substituted

for 25-mesh ones. The percentage of coarse sand was 48; of fine, 52.

At the South Crofty mine the joint tailings from the mill are conveyed by a leat 3 ft. wide to ponds about 50 yd. away. From the latter part of the leat, which is on the sloping ground the tailings deposited were stripped and treated on Buss tables without pulverization. With daily stripping these concentrated only to about 2 per cent. cassiterite, although the proportion of mispickel was high.

Results of the Tests

All this investigation served to show the losses in the first stage of concentration as due either to insufficient crushing or to leakage on the concentrating tables. From the probable distribution of the tin as figured by the use of heavy solutions it appears that extremely fine crushing is necessary for a good recovery. On the other hand the change from 25-mesh screens to 20-mesh ones, as before noted, was accompanied by no higher losses. More experiment on this point of coarse crushing would be exceedingly instructive.

A comparison of the results obtained at three different mines using the same general milling practice on similar ore brings out more than anything else the nature of the ores treated as regards concentration. Mr. Hutchins finds the practice of pulverizing burnt leavings good, but finds no evidence to support such treatment of middlings from Buss tables. He takes only one head from his tables although the more recent plan is to take two, retreating the second heads from two or more tables on another one.

In general the tests show that coarse grains in the tailings carry higher cassiterite than fine ones, but the difference is not very apparent except in the case of rich tailings. The experiments with Sonstadt's solution indicate that a fairly large proportion of the cassiterite-carrying grains were of low specific gravity and even in the strippings from the leats where there was a certain proportion of similar grains presumably of higher specific gravity it is doubtful if their density was even high enough to class them as middlings. Coarse crushing was found to give coarse grains showing increased value, while too fine crushing gave slimes of high value.

The discovery of a new element is announced by M. Ogawa, of the University of Tokio, in the rare mineral thorine, in which it occurs as small yellow or red crystals, hard enough to scratch glass. These are found to be a double silicate of the new element and zirconium. The new element has been named nipporium; its symbol will be Np.; its atomic weight is probably 100.

Colorado State Geological Survey

A report of progress recently issued shows that field work in the past year includes four important areas: (1) The area about Hahn's Peak in Routt county, 110 square miles. (2) The tungsten field of Boulder county, 90 square miles. (3) The sedimentary formations flanking the foothills from the Wyoming line southward for 75 miles. (4) The Montezuma area in Summit county, 22 square miles.

Rock Mineral Analyses

In connection with the field work of the Survey about 50 complete chemical analyses and assays, and upward of 100 other determinations have been made. The State Survey will not do work which should go to private chemists and assayers, but only that demanded by its own reports.

Topographic Map of Colorado

The Hayden survey of the Territories, completed in 1878, made a topographic map of about two-thirds of the State. The King survey of the Fortieth Parallel included a narrow strip about two-thirds of the way across the southern border of the State. Of the area not covered by these two surveys, over one-half has been mapped in detail by the present United States Geological Survey. The other half has been mapped in less detail. The maps of the earlier surveys are available to but a very small number of people, and those of the present survey are contained in about 60 separate sheets.

The State Geological Survey has compiled a topographic map of the State on a scale of 1 in. to 8 miles, combining, so far as the scale would permit, the results of these various surveys, and including all the geological details usually found in a complete State map. This map will be used as a base for the revised geological map, and for maps showing the various mineral deposits, water resources and other economic features of the State. The map is almost ready for the engraver.

Geological Map of the State

The only geological map covering the State is a small one, on a scale of 12 miles to the inch, published by the Hayden survey in 1879 and 1881. This is very general and incomplete. The larger Hayden atlas covers only two-thirds of the State. A vast amount of detailed geological work has been done in Colorado during the last 30 years, and has modified in many important ways, the conclusions reached by the Hayden geologists in their hurried survey. The results of this later work are published in perhaps 40 separate maps, many of which are not easily available.

The State Geological Survey is compiling a map, on the same scale as the topographic map, which shall bring together, so far as the scale will permit, the results of all geological work done in this State up to the present time. The drafting is probably three-fourths done, and the explanatory sketch of the geology, to accompany the map, is also well under way.

A map showing the various metalliferous deposits of the State is approaching completion. Another showing the location of the coalfields is ready for the draftsman.

A bibliography of the geological literature of Colorado is well under way, and already contains over 5000 classified entries, together with reference letters indicating the important libraries of the State, in which the book, article or report may be found.

Other Work Commenced

A report on the distribution, qualities and value of the clays of the State. (Prof. G. M. Butler, School of Mines.) The building stones and marbles of Colorado. (R. D. George and A. P. Poorman.) Cement materials, limestone and gypsum. (Direction of R. D. George.) Descriptive geology of the State in two bulletins: (1) General geology; (2) economic geology. (R. D. George and Professor Crawford.)

Staff of the Survey

Prof. R. D. George, University of Colorado, State geologist; Prof. H. B. Patton, Colorado School of Mines, geologist; Dr. James Underhill, mining engineer, Idaho Springs, geologist; Prof. G. M. Butler, Colorado School of Mines, geologist; Prof. R. D. Crawford, University of Colorado, geologist; Prof. C. E. Smith, Colorado School of Mines, geologist; Prof. Junius Henderson, University of Colorado, paleontologist; Prof. J. B. Ekeley, University of Colorado, chemist; C. C. Williams, A. P. Poorman, draftsmen; B. H. Jackson, W. M. Lewis, T. D. Benjozsky, field assistants; R. M. Budtters, G. D. Kendall, H. Whitaker, F. H. Millard, chemical work of various kinds.

The vagaries of boreholes have recently had a fresh illustration, says the Kalgoorlie correspondent of the *Mining Journal*. Some years ago a hole was put down at an angle from the surface of the Central Boulder lease, and at a depth of 1500 ft. a rich vein of telluride ore was cut, in what was then thought to be the Central Boulder ground. A subsequent survey of the hole showed that the drill had diverted, and it was then announced that the telluride was in the Oroya South lease, and not in the Central Boulder block. Now comes the news that the bore hole has been struck at 1200 ft. in the Kalgoorlie lease, which lies east of the Oroya South block, and which is now owned by the Oroya Brown Hill Company.

A new tin find is reported from the Stannary Hills district, Queensland (*Aust. Min. Stand.*, Dec. 16, 1908), the discovery being near the Lass o' Gowrie mine.

Sinking in Wet Ground by Injecting Concrete

After Sealing Fractures in Surrounding Rock by Injections from Churn-drill Holes, the Shafts Were Easily Sunk through Very Wet Ground

BY JULES LOMBOIS*

The Compagnie des Mines de Béthune has had to sink three shafts through watery ground; in each instance a cementing process was employed. The shafts were sunk in successive years, so the experience gained in each was brought to bear on the next. Consequently a record of our operations ought to be instructive to other engineers engaged in the same kind of work.

In the vicinity of shafts 11 and 11 *bis*, the coal seam is covered by 150.4 m. of Cretaceous sediments, composed of the following strata: Fissured white limestone, 46.2 m.; hard sandstone, 0.8 m.; gray phosphatic limestone, 6.3 m.; bluish marly limestone, *"bleus,"* 32.7 m.; greenish marly limestone, *"diêvies,"* 32.5 m.; slightly argillaceous white limestone, 22.5 m.; conglomerate, 3.4 m.; shales, 6 m.

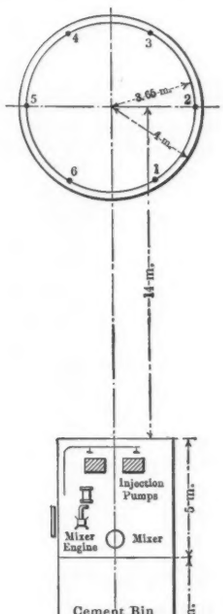
The fissured white limestone is the source of the most of the water. The gray limestone yields only a little. The blue limestone is only slightly fissured, but occasionally affords a strong flow of water. The green and the lower white limestones are both compact. The problem was thus to solidify, by cementation, the white, the gray and the blue limestones by bore holes regularly distributed around the circumference of the proposed shaft.

I shall first outline the mode of operation at shaft No. 11, in 1904, and at shaft No. 11 *bis*, in 1905, pointing out such improvements as occurred, and shall then describe, in some detail, the sinking of shaft No. 7 *bis*, in 1906 and 1907.

Shaft No. 11

This shaft was first dug with a diameter of 5.2 meters to a depth of 4.2 meters. Four holes were then bored, equidistant from each other, and at 2.36 m. from the center. On account of the long time required to sink holes and cement them in the usual way, by successive advances, it was decided to inject cement into two of the holes while they were being bored. Two of the holes, of 300 mm. diameter, were therefore bored and injected with cement in alternate stages, while in the other two, of 180 mm. diameter, boring and injecting went on at the same time. A churn drill was used for all.

The cement mortar was mixed by hand, using ordinary portland cement, and was then injected into the holes, the tops of which were closed by iron pipes with the necessary connections, by a Burton pump, affording a maximum pressure of 4 kg. per sq.c. The holes were lost twice owing to the premature setting of the mortar. Operations lasted a little over two months, during which time 1776 sacks of cement, weighing 50 kg., were injected; of this, 70 per cent. was absorbed by the holes bored in the ordinary way, and 30 per cent. by the holes which were injected during boring.



GENERAL PLAN OF INSTALLATION

As the rock was exposed by subsequent sinking, the following facts were noted: In the white and gray limestones, the fissures were perfectly filled but the seams of cement were very variable, being compact and hard in some places, but in others soft and yellowish, imperfectly set, and without strength. These poor results were attributable to the coarseness of the original cement, which permitted separation of its coarse and fine particles, and to incomplete mixing of the mortar. In the blue limestone, solidification was fairly complete in the upper portions, which were only slightly argillaceous, but below this, where the marls contained around 18 per cent. of clay, all traces of cementation had disappeared. The poor success in this rock was due to chips of clayey material which would lodge in the crevices and resist the injection of cement even under a pressure of 10 kg. per square centimeter.

Shaft No. 11 *Bis*

This shaft is at a distance of 48 m. from No. 11. The principal improvements over the operation as conducted at the first shaft were the following:

After the shaft had been sunk and lined with masonry to a depth of 14 m., with an inside diameter of 5.2 m., the four holes were drilled on the outside of the shaft, equidistant from each other and at a distance of 4.07 m. from the center. The holes were all bored and injected alternately, which permitted the application of the full force of the pump. In the white and gray limestone, the holes were bored with a churn drill, but in the blue marl a special auger was used which prevented the choking of the fissures by chips of rock. Three applications of the auger were sufficient to gain 1.5 m. depth, which was adopted as the advance for each stage of drilling and cementing.

Instead of the ordinary portland cement used at shaft No. 11, a specially fine cement was employed, of which only 16 per cent. would not pass a screen having 170 meshes per inch. Mixing was still done by hand.

In the white limestone strata above the water level, the injections were made without a pump, all necessary pressure being obtained by placing the mixing box on a platform at a hight of 4.75 m. above the ground. The object of this was to form, for the upper 45 m., a solid mass of concrete which would withstand the pump pressures required for injecting the lower, water-bearing strata. In spite of this precaution, when the pump pressure was applied openings appeared between the drill holes and the bottom of the 14-meter pit, and it was never possible to hold a pressure of more than 10 kg. in the first two holes. In order to inject the blue limestone thoroughly, the third and fourth holes were cased with pipe, having 3-mm. walls, down to the top of that stratum. Even then two leaks occurred during the injecting of these holes, which had to be repaired by using a 35-per cent. mixture of cement.

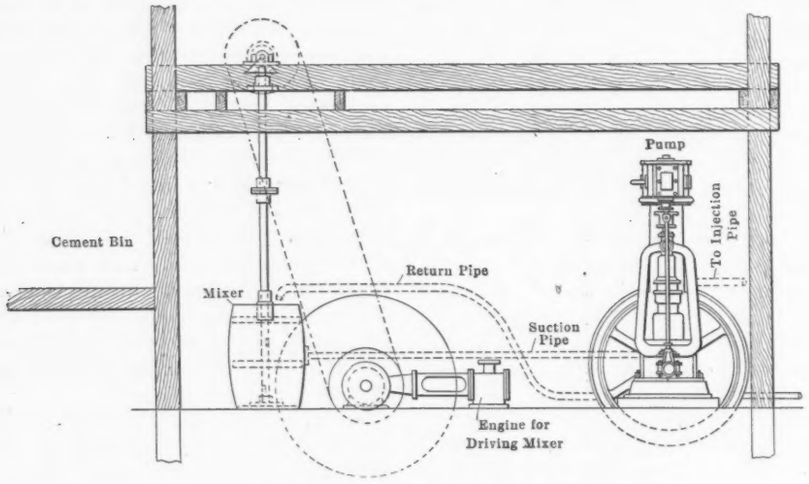
The total amount of cement used in

NOTE—Abstracted from *Bulletin* de la Société de l'Industrie Minérale, Tome IX, No. 4.

*Chief engineer, Compagnie des Mines de Béthune.

this shaft was 4981 sacks (50 kg.). By using the alternating method, and a Weise & Monsky vertical, compound pump capable of high pressures, it was possible to force 3997 sacks of cement into the water-bearing strata, instead of only 761 sacks, as at shaft No. 11.

The results of this method were very satisfactory. Almost all the fissures were found to be well filled with solid seams of cement of grayish black color and homogeneous composition. Only two seams contained yellowish, soft cement and these did not yield much water. At a depth of 88 meters only 5 cu.m. of water had to be raised per 24 hours, as against 145 cu.m. at the same depth in shaft No. 11. Shaft No. 11 *bis* was begun at a depth of 14.9 m. on May 14, and finished completely to 94.92 m. by July 13, 1906. The average daily advances to this depth were thus: For sinking, 3.47 m.; for lining, 2.18 m.; for sinking and lining, 1.34 m. per 24 hours.



MIXING AND PUMPING PLANT

Shaft No. 7 *Bis*

The measures to be perforated at this shaft have a total thickness of 142.5 m., consisting of the same strata as at No. 11 and having about the same relative thicknesses, except that the bluish, marly limestone is somewhat thicker and the greenish limestone much thinner than at the former shaft.

The water level varies from 17 to 29 m. At No. 7 shaft, sunk some years earlier, as much as 1700 cu.m. of water had been pumped, per day, from a depth of 66.5 m. Furthermore, two important seams of coal had already been completely extracted from this vicinity, which gave reason to fear that the overlying strata would be found to be badly fissured. For these reasons it was thought wise to sink six injection holes, instead of four.

A preliminary shaft was first dug to a depth of 3.5 m. in order to facilitate operations and to afford a fairly solid stratum for inserting the injection pipes. The pit was lined with masonry to an inside diameter of 8 m. The six holes, evenly spaced around a circumference with 3.65-m. radius, were then bored and injected in successive stages. As at No. 11, each hole was made with a churn drill in the hard measures and with a rotary, auger drill in the soft argillaceous strata.

In order to guard against leakage around the upper ends of the holes, and to insure the application of the full pump pressure, a little shaft, 5 m. deep and 1.30 m. diameter, was dug at the spot to be occupied by each hole; the lining pipe was then inserted and the space around it was carefully filled with well rammed concrete, with frequent applications of cement grouting. The lining pipe was of steel, 8 mm. thick and with an inside diameter of 300 mm. Its upper end had a cast-iron head, to which the necessary pipe connections were made. A 50-mm. pipe, fitted with a pressure gage and a stop cock, entered the side of the casing pipe just below its head. During the preliminary washing of the hole, which followed each drilling operation, this pipe carried off the muddy water; as soon as the water came up clear, the pipe was connected to the cement mixer in order to return to it the excess of cement toward the end of the injecting process.

For boring through the limestones, the contractor at first tried a drill which was too light and resulted in the loss of two holes; after this had been replaced with a heavier drill, on the Hulster, free-falling system, it was possible to make an injection of cement and bore the hole 5 m. deeper in six hours. For boring in the argillaceous measures, a new auger was made, 2.50 m. long, 175 mm. diameter, with turns pitched 370 mm. apart. The adhesion of the cuttings in marl was sufficient to bring them to the surface, attached to the auger. Three applications of the auger would deepen the hole 3 m. Two reamers, the first of 225 mm. and the second of 245 mm. diameter, were then used to scrape the walls of the hole so as to remove any cuttings from the crevices. The drill stem, formed of steel tubes 5 m. long and of 66 mm. interior diameter, was used for injecting the cement. The force for operating the reamers was furnished by a 12-h.p. portable engine. The time required for advancing 3 m. by this method was a little over 13 hours; toward the end of the operation it became possible to bore and inject 3.10 m. per day.

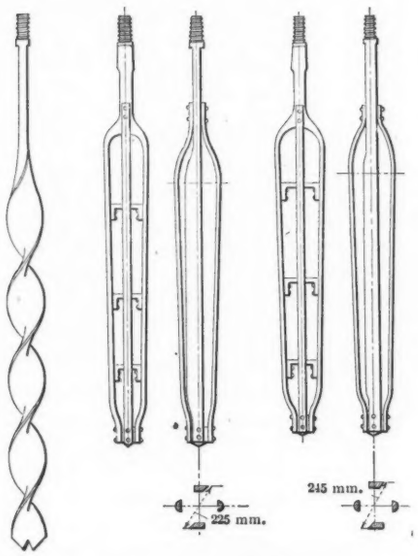
To afford a more perfect mixing of the mortar, as well as to save in labor, a mechanical mixer was installed. It consisted of a 150-liter cask, carrying a vertical shaft to which four paddles were fastened; the shaft making 60 r.p.m. The cement and water were thrown in at the top, and the mixture ran off to the pumps through suction pipes which left the cask at 40 cm. from the bottom, that is, a little above the level of the suction valves of the pumps.

The pumps were of the Weise & Monsky, compound type, with flywheel; the two plungers were of 90 mm. diameter and 200 mm. stroke, yielding, at 75 r.p.m., a flow of 9.5 cu.m. per hour; the suction was 50 mm., and the discharge 40 mm. in diameter. To avoid the corrosive action of the cement, the bronze valves were replaced by steel balls, 105 mm. diameter, weighing 4.52 kg. apiece. The force with which these balls fell upon the bronze seats of the valves kept the latter free from adhesions and maintained a smooth and regular operation. These precautions permitted the passing of 2500 sacks of cement without any difficulty, whereas, at No. 11 *bis*, the valves had to be changed after every five hours, or for every 60 to 80 sacks.

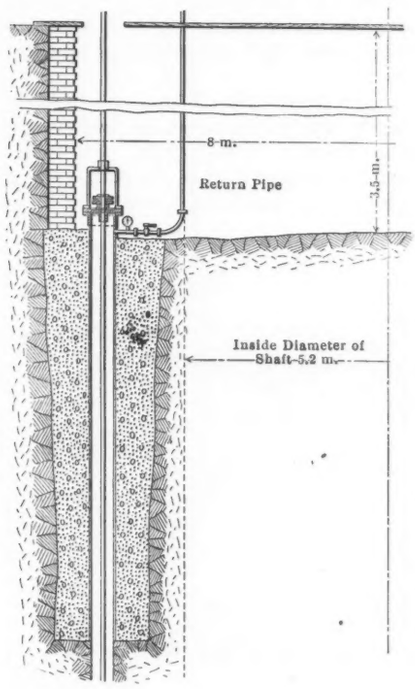
All the strata from the bottom of the casing pipe, at 8.5 m. below surface, down to the bluish marls, were injected in successive 5-m. stages, with the whole pressure of the pump, 20 to 25 kg. per sq.c. The injection pipe was formed of sections 5.4 m. long, having an inside diameter of 40 mm., and connected by outside bronze couplings. The relatively small section of the pipe compelled a rapid circulation of the liquid in the pipe and around the bottom, whereby any tendency of the mortar to separate was overcome. At the surface, the end of the pipe was connected to the pump by a strong rubber hose which permitted a certain amount of vibratory and sliding motion of the pipe, which was given it to prevent accumulations of cement. The procedure was as follows:

After the injection pipe had been lowered to within 1 m. of the bottom of the hole, the head gear of the casing pipe was bolted together. Clear water was then put through the pump, the cock in the return pipe at the top of the casing

being left open; after about an hour the return water would become clear. The cock was then closed and the pump driven to full capacity in order to force any remaining débris as far back as possible into the crevices of the rock; this process lasted about half an hour. Then, without changing any other conditions, cement was added gradually, to form about 5 per cent. by weight of the mixture; after an hour of this, the percentage of cement was raised to 10, if no increase had been noted in the pressure in the hole. As the cement deposited in the fissures of the rock, it became necessary to increase the pressure at the pump. Finally, as the fissures became more thoroughly plugged, in order to avoid too great pressure and the stopping of the pump, the cock in the return pipe had to be opened little by little, the excess of grouting being carried back to the mixer. Toward the end, the consumption of cement was reduced, and the pipe was kept in active motion. The operation was finished when it became necessary to keep the return pipe entirely open to maintain the operation of the pump. The pump and the pipes were then cleaned by a current of water, after which the pipe was withdrawn and the hole was left eight hours to allow the cement to set.



AUGER AND REAMERS



SECTION THROUGH ONE BORE-HOLE

It was often noted that the pressure in the pipe would suddenly drop. This event was due either to the dislodging of a partially solidified cement plug, or to the opening of a channel connecting the hole with the surface. The latter case occurred frequently when the upper part of the section of rock to be cemented was soft. Crevices of this sort were stopped by injecting a thick mortar, 30 to 35 per cent. cement, under low pressure. Another way was to line the hole, down to some solid stratum generally at 20 m., with a pipe slightly smaller than the upper casing pipe. Occasionally, also, the cement injected in one hole would reach and flow into another hole which had been temporarily abandoned upon reaching the marls. To avoid this, whenever work was suspended in any hole, it was filled with sand; the sand could afterward be removed easily by a water jet.

After having injected all six holes down to the marls, these latter were then treated in exactly the same way. The amount of cement used in the limestones was 1514 sacks, and in the marls, 1594 sacks. The time occupied was 10 months and 10 days, including Sundays and holidays when no work was done. This rather excessive length of time was due to the accidents and losses of holes arising from the inexperience of the workmen. Before operations were over, it was possible to sink and inject 5 m. in the limestones and 3 m. in the marls per day.

The holes were bored by a contractor; at the end of each advance, the borers would assist the company's men in making the injections. In addition to the contractor's men, the entire force included a foreman, a fireman, and two laborers.

The sinking of the shaft then began, and was completed in five stages. The strata were found so thoroughly solidified that explosives had to be used. A number of crevices, from 1 mm. to 11 cm. wide, were found to be filled completely. At a depth of 87 m. the total seepage was only 1.166 cu.m. per hour. Down to the 395-m. level, the average daily advances were 3.05 m. for sinking; 4.71 m. for lining; and 1.85 m. per day for both sinking and lining. This excellent speed was mainly due to the freedom from water in the shaft.

The main advantages of this method are its cheapness, in that only a small and inexpensive equipment is required and the cost of labor and material is small; and its practical advantages, in that water is almost completely shut out, the erection of masonry linings is made more secure, the solid wall of concrete makes a lining almost unnecessary, and finally any repairs to the lining are more easily executed.

Phelps, Dodge & Co.

Phelps, Dodge & Company, Inc., reports to the Stock Exchange assets and liabilities as of Jan. 31, 1909, as follows:

ASSETS.

Copper Queen Consolidated Mining Company stock, 199,516 shares at $135	$26,934,660
Moctezuma Copper Company stock, 26,000 shares at $307 13/15	8,000,000
Detroit Copper Mining Company of Arizona stock, 40,000 shares at $150	6,000,000
Stag Canon Fuel Company stock, 5000 shares at $800	4,000,000
Organization expense	25,000
Total	$44,959,660

LIABILITIES.

Capital stock, 449,346 80/100 shares at $100	$44,934,660
Phelps, Dodge & Co. (firm)	25,000
Total	$44,959,660

Included in the report to the Stock Exchange are the reports of the Copper Queen Consolidated Mining Company, the Moctezuma Copper Company and the Detroit Copper Company:

Copper Queen Consolidated Mining Company's general balance sheet Dec. 31, 1908, follows:

ASSETS.

Mines and mining claims		$500,286
Plant and real estate		2,227,243
Courtland mine development		58,183
Stocks, bonds, etc		2,181,436
Loans and mortgages		288,275
Bills receivable	$36,281	
Accounts receivable	1,476,415	
		1,512,697
Cash		1,428,524
Inventories		5,336,396
Total		$13,533,043

LIABILITIES.

Capital stock	$2,000,000
Accounts and drafts payable	1,181,764
Contingency expense	14,936
Plant renewal	1,440,000
Balance, surplus, Dec. 31, 1908	$8,896,342
Total	$13,533,043

The income accounts of the Moctezuma Copper Company and the Detroit Copper Company for the year ended Dec. 31, 1907, follow:

	Moctezuma.	Detroit.
Net income for year	$833,236	$814,874
Previous surplus	1,182,769	739,621
Total surplus	$2,016,006	$1,554,495
Dividends	130,000	*200,000
Profit and loss surplus	$1,886,006	$1,354,495

*Includes $120,000 plant renewal fund, and $80,000 dividends.

The tube mills used in Australia are smaller than those generally used in the United States, Mexico and South Africa.

A Method for Setting Timber in Inclined Shafts

By C. W. McDougall*

The method of setting timbers in an inclined shaft, which is described in this article, has been found to be very good after a test under various conditions, extending over two years.

The apparatus used consists of a special try-square, a carpenter's spirit level, a wooden straight-edge, 10 ft. long, and a transit. The try-square is made of wood according to dimensions shown in Fig. 1; the target on it is an ordinary level target with alternate red and white quadrants. This target slides on a piece of hardwood attached to the front of the try-square.

The transit is mounted on a bracket which can be attached to the sleepers in the shaft, thus doing away with the difficulties of a tripod set up, especially in a steep shaft where there is danger of the instrument's falling. The bracket also gives more room to the instrument man, while making observations.

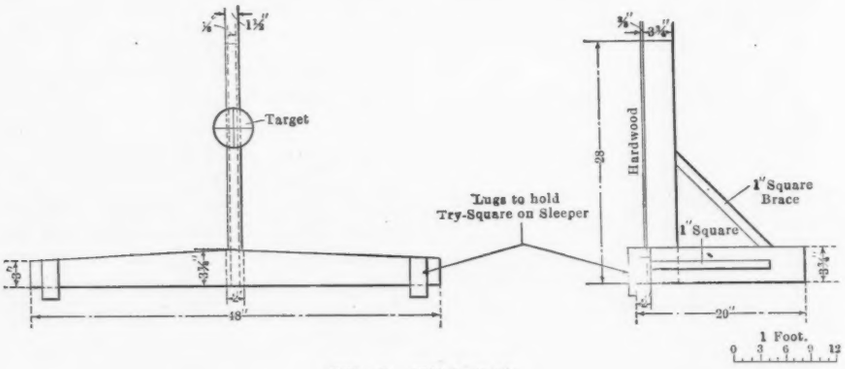


FIG. 1. TRY-SQUARE

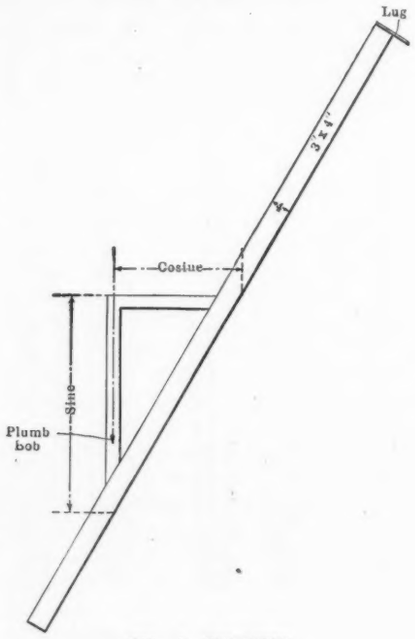


FIG. 2. DIP LEVEL

Method of Setting "Check" Sleepers

The instrument is set up in the shaft on the bracket over a point on the center line of the shaft, or on some line parallel to the center line, and sights are taken to place the line of collimation parallel to the center line of the shaft. Then, after the center line of the transit has been set at the proper dip by means of the vertical arc, the instrument man is ready to proceed.

The try-square is placed in the center line on a sleeper that has previously been set, and the target moved up or down until the horizontal cross wire in the telescope coincides with the horizontal center mark on the target. The target is then clamped in position, and the try-square is moved to the sleeper that is to be set. The try-square is placed on the center line and a sight is taken at the target which, since its position represents the hight of the instrument above the face of the sleepers when set on the proper dip, must not be moved. The sleeper that is being set is then moved either up or down until the center of the target coincides with the horizontal cross wire of the instrument. The sleeper is kept in a level position horizontally by means of a long straight-edge and a carpenter's level.

After the sleeper has been set in the proper position and secured, the balance of the set is trued, and the work of placing the next set begins. In truing the set, and in setting the sleeper, or footwall plate, care should be taken to have the set placed normal to the dip of the shaft, or canted by the same amount as was the original set, otherwise the reading on the target will be wrong in a manner similar to the reading on a level rod when the rod is not held in a perpendicular position.

Care should also be taken to have the center line of the try-square on the line of collimation of the transit. The transit and try-square need to be used only to set sleepers about 50 ft. apart so as to check up the work and keep the shaft in line.

The usual time required to set a sleeper, under ordinary conditions, is 30 to 45 min., divided as follows: Setting up instrument, about 15 min.; setting sleeper depending on the distance it must be moved and whether wedges or jacks are used in moving the timber, 15 to 30 minutes.

Method of Setting Intermediate Sleepers

To set the intermediate sleepers, a dip level such as is shown in Fig. 2 is used in conjunction with the straight-edge and carpenter's level previously mentioned.

The proper dip angle is laid off by means of natural sines and cosines on the bars forming the square mounted on the straight-edge, the two legs of the square being the sine and cosine, respectively, of the dip angle. The accuracy of the triangle formed by the square and straight-edge is proved by calculating the length of the hypotenuse of the triangle.

To use the dip straight-edge, one end is placed on two sleepers that have been previously set and on the center line, and the sleeper to be set is brought to the proper elevation, which will be indicated by the coinciding of the plumb line on the straight-edge with the mark previously made for a guide. Then the sleeper is brought to a horizontal position by using the carpenter's level in conjunction with the transit.

In truing the sets, it was found very convenient to have a large square made in order to test the angle of 90 deg., formed by the end plates and dividers with the footwall plate, or sleeper. When the intermediate sleepers had been set with the dip straight-edge, using a proper amount of care, the greatest error found by checking with the transit was not more than one-half an inch, and this may readily be accounted for by the fact that ordinary squared timbers are seldom exactly true, either in section or longitudinally, and also by the possibility of a slipping of the wedges that held the sets in place.

According to B. I. Collins in a paper before the Chemical, Metallurgical and Mining Society of South Africa, the ultimate mining future of the Rhodesian goldfields lies in the development of the large low-grade bodies of impregnated ironstone, schist, and conglomerate, rather than in the small and non-persistent quartz veins. At present most of the mines work the latter class of deposit and are operated by small workers with rather insufficient equipment. These small operators cannot afford to extend their operations to the big low-grade orebodies, since there the values are irregularly distributed, and extensive prospecting is required to ascertain accurately their value.

*Chief engineer, Hancock Consolidated Mining Company, Hancock, Mich.

The Stephens Climax Imperial Hammer Drill

By Eustace M. Weston*

An English firm, R. Stephens & Son, of Cornwall, has designed a hammer drill built as largely as possible on the lines of a piston drill and having every part readily accessible for inspection; this is the latest type of hammer drill especially designed to meet the conditions on the Rand. In designing this drill, it was determined to construct a machine of the maximum power possible within the limiting weight of 100 lb. laid down as the maximum weight allowed for machines competing for the £4000 prize on the stoping-drill contest. In this drill air consumption has not been considered an important item. The consumption is given as being about three-fifths that of a 3¼-in. drill. It would therefore be about equal to that of a 2¾-in. drill or from 70 to 80 cu.ft. per min. with air at a pressure of 80 lb. per sq.in. The machine complete weighs 95 lb.—20 lb. more than the Gordon drill. With an air pressure of 75 lb. per sq.in., the number of strokes per minute is said to be about 700.

The length of stroke is 5 in.; the diameter of cylinder is 1¾ in. and the weight of the hammer is 6½ lb. It will be seen that this drill is more powerful than any American stoping drill except the Leyner model 6 machine. The general construction of the machine which includes some novel features can be seen from the accompanying sketch sections. Fig. 1 is a longitudinal section; Fig. 2 is a transverse section. The half-tone illustration shows the machine set up for work and also two drill bits. In Fig. 1, *A* is the anvil block. It is about 9 in. long by 1¾ in. diameter; it weighs 8 to 10 lb. The anvil block and pinion wheel *G* are made in one piece and from special steel. This pinion wheel prevents the anvil block's being forced back into the cylinder. It will be noted that it is provided with a taper recess for a taper chuck *C*, having a water-feed channel *W F C* through it. This channel communicates with a brass water-feed ring *W*, which is surrounded by buffer rings made water-tight by packing *P K*. Water is led from the two-way throttle valve, shown in the half-tone illustration, through the channel *W F C*, along the side of cylinder and front head to the brass water-ring *W*.

The amount of water used is regulated by means of two cocks—one on the hose; the other, a brass screwhead, on the machine itself. No air passes down the hollow steel with the water. Any water leaking past the ring toward the cylinder drains away through holes *E S W*.

The pinion wheel *S* gears with the spur wheel *G;* this is rotated by the crank handles *R H* to which it is connected by a telescopic rod. The rotation is thus geared and positive being operated by hand similarly to the way that rotation is effected in the Leyner Rock Terrier drill, which this machine resembles somewhat. *G F* is the main cylinder casting and slides in the flat cradle *K*. It is bored out for two cylinders; *A F C* is the air-feed cylinder, *A F P* is the air-feed piston attached to cradle *K*. The air admitted to the machine enters the air-feed cylinder and feeds the machine forward before it enters the main cylinder; as soon as the air is turned off, *A F C* is opened so as to exhaust. The drill must be slid back by hand, but as the drill is light and the holes seldom vertical this can be easily done. Another forward feed is gained (see Fig. 2) by sliding the cradle forward in the clamp. One side of the cradle has teeth on it; when the clamp bolt is loosened the cradle slides easily forward and is then securely fastened again by the toothed clamp when it is tightened. With these two feeds, a total advance of 28 in. is gained; this is ample in the hard ground here, where hammer-drill bits are generally blunted after boring 12 or 15 inches.

The main cylinder *X* is 1¾ in. in diameter. The piston *P* is of shape shown. *P O* and *P O'* are the air ports; *V B* is the valve chest; *V* is a piston valve, and *A V* and *A V'* are two leather auxiliary valves. They are conical leather plugs which control the exhaust from the valve ends. They are pushed down so as to always make an air-tight sliding fit with the piston P, no matter how worn the cylinder may be. Thus the valve movement is kept regular.

The valve action can be seen from Fig. 1. The air is allowed to leak past each end of the valve from the live-air chamber in the center of the air chest in sufficient quantity to throw the valve over when the other end is open to exhaust. The movements of the piston *P* place each end of the valve chest alternately in connection with the atmosphere through *A V* and *A V'*, the recess in piston *R'*, and the two exhaust ports *E X* and *E X'* in the walls of the cylinder. In Fig. 1 the piston *P* has finished its stroke, and *A V'* is open to exhaust so the valve will be thrown over for the return stroke. The valve could be set to cut off and use air expansively on either front or return stroke. This is done in the large piston drill made by the same company, but I do not know whether or not this is done in the hammer drill. It will be noted that the valve motion is simple and that the valve can be easily inspected. The machine is held together by side rods *S R*. The packing in the front head can be readily taken out and changed if it becomes worn.

The novel points about the design are: First, the compact air feed which allows the machine's being kept short and so made similar in shape to a piston drill, and yet without a feed screw; second, the great weight of the anvil block—this would seem at first to be a great mistake in design; third, the adoption of the taper chuck attachment. This makes the anvil block simply a part of the drill bit as it fastens immediately to the drill shank. This construction seems to me to reduce vibration greatly and to be the reason why the makers say that they have had no trouble with breakages of this part, in spite of the fact that it has holes bored in it and of the difficulty that every maker finds in tempering anvil blocks with holes in them. The anvil block is always "up to its work" and there is never any lost motion between it and the drill owing to rebound. Of course, a somewhat harder blow has to be struck to make up for the greater inertia of the combined boring tool, but the advantage gained seems to outweigh this.

The machine does not seem to be very economical in air, for the cylinder volume

STEPHENS CLIMAX IMPERIAL HAMMER DRILL

*Mining engineer, Mbabane, Swazieland.

on the return stroke is large, owing to the fact that there is no piston rod to take up this space. The length of the machine over all is 2 ft. 10 inches.

I witnessed a trial of this machine on a block of granite similar to that used in the South African mines stope-drill competition. The hole drilled was horizontal, the water pressure about 10 lb. and the air pressure 80 lb. per sq.in. The machine bored about 12 in. with a 1¼-in. double-chisel bit, 13 in. with a 1⅛-in. chisel bit and 14 in. with a 1-in. chisel bit; or a total of 39 in., in a total time of 9 min. 22 sec., or an actual drilling time of 8 min. 48 sec. The average speed was 4.23 in. per minute.

In another trial 36½ in. was bored in 12 min. 15 sec.; the bits were chipped and well blended. It will be noted that the width of the bits used was less than that of those used in the South African mines trials; had the drilling been done with 1½, 1¼- and 1⅛-in. bits, the rate of drilling would be slower. In the Government trials in 1909 the finishing gage of the holes at a depth of 48 in. must be 15/16 in. This means that holes will have to be started with 1¾- or 1½-in. bits. I have already shown what effect this has on boring speed. This machine, I should say, has a speed of boring equal to that of a 2¾-in. piston drill having a 6-in. stroke and boring with bits of the same size; but the Stephens is, of course, lighter, smaller and more easily handled than the piston drill, while with a double-pointed wedge key the drill bits are changed very rapidly indeed. The shape of drill bits used is shown in the half-tone illustration. The shank ring is necessary for taking out the bits by means of the key.

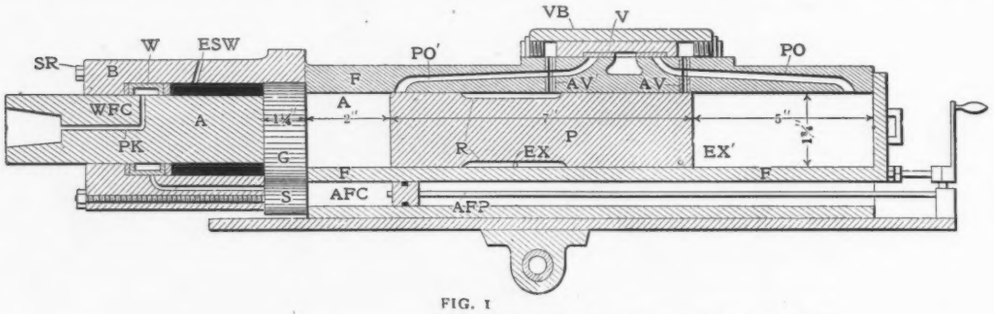


FIG. 1

STEPHENS CLIMAX IMPERIAL HAMMER DRILL

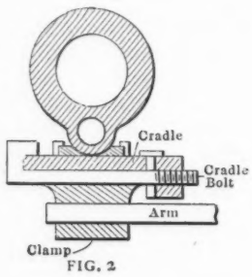


FIG. 2

An increase from 3,500,000 gal. of the oil of coal tar, or creosote, imported into the city of New York in 1904, to an amount estimated to be almost 25,000,000 gal. in 1908, is one of the indications pointing to the progress of the nation-wide movement for the conservation of forest resources. It is creosote which the Government and scores of corporations and private wood users have found to be one of the most satisfactory preservatives of railroad ties, mine props, telephone and telegraph poles, fence posts, and for timbers used for commercial purposes.

Cumberland Ely Copper Company

The report of the Cumberland Ely Copper Company, Feb. 5, 1909, shows that for the year ending Nov. 30, 1908, $1,190,521, was expended in development work, and its proportion of the cost of construction of the Steptoe Valley Smelting and Mining Company's plant.

During the year a four-compartment shaft was sunk and is now in service. A large electric hoisting plant, with self-dumping skips, was installed and has proved most satisfactory. Ore bins were constructed and the requisite number of buildings for the accommodation of employees completed, together with an extensive pipe line which furnishes an abundant supply of water for all purposes at the mine.

The success of the caving system of mining was fully demonstrated, and is producing satisfactory results. Up to Feb. 1, 1909, 198,611 dry tons of ore were mined, of which 177,589 tons were milled, showing an average copper content of 3.1 per cent. The production at the present time is at the rate of 1200 tons per day. The railroad to the concentrating and smelting plant at McGill has been in operation for some time, and is so constructed and equipped that it can readily meet all demands made upon it for the transportation of ore and other traffic.

The average extraction was 71.19 per cent., and during December and January, 73.33 and 76.12 per cent., respectively.

The accompanying table shows comparative assets at the end of Nov. 30, 1907 and 1908.

COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES.

Assets.	November 30, 1907.	1908.
Property account:		
Cost of mine, including expenditures for construction and development	$4,371,017.33	$4,676,538.88
Investment account:		
Cost of capital stock of other companies	3,315,000.00	4,100,000.00
Material on hand	.....	36,222.74
Metals:		
Value of metals refined and in process, less advances on same	.....	353,489.77
Cash and cash items	1,077,243.47	37,783.01
Total	$8,763,260.80	$9,204,034.40

Liabilities.		
Capital stock:		
1,300,000 shares at $5	$6,500,000.00	$6,500,000.00
Surplus account:		
Difference between par value and amount realized for capital stock issued	2,141,122.25	2,141,122.25
Accounts payable	19,093.72	250,488.44
Profit and loss	103,044.83	312,423.71
Total	$8,763,260.80	$9,204,034.40

Pennsylvania Railroad's New Coke Cars

In an effort to provide shippers of coke with an improved car, which can be loaded and unloaded in the shortest possible time, the Pennsylvania lines west of Pittsburg have specified that of the recent order for 2200 new cars, 1000 shall be all-steel cars of new design and of greater capacity than any coke cars hitherto built for regular service.

The main novelty in these cars will consist of four hoppers, with eight openings in the bottom of the car, making the car practically self-clearing. With the doors all open, there will be an open area of 84 sq.ft. This will greatly facilitate unloading. It has been found that three somewhat smaller cars could be unloaded by three men in 15 minutes from the time they were placed on the trestle until the engine moved them away. From the time the drop doors were opened until the coke ran out of the car required 1 min. and 45 sec. The four-hopper car is expected to do even better.

To facilitate loading, it is planned that the old-fashioned coke racks shall be left off these cars, and the sides of the cars will not be as high as in previous designs. This loss is repaired in the greater length, 42 ft., of the new cars. The drop doors are to be provided with operating gear of special design. The total capacity of each of the new cars is 2794 cu.ft., providing for a load of 100,000 pounds.

In breaking ore the face of the stope should be carried so that the greatest advantage can be taken of any weakness in the ore such as schistosity, fracture planes, and jointings.

The United States Steel Corporation

The Returns of the Great Corporation for a Year of Industrial Depression. A Loss of $250,000,000 in Gross Receipts, but Dividends Are Continued

BY FREDERICK HOBART

The report of the United States Steel Corporation, covering the calendar year 1908 gives, as usual, a comprehensive statement of the business of the company. The figures are so large and the transactions covered so varied and extensive, that proper analysis of the report is a work of some time. It illustrates well the great reaction which affected the iron and steel trades in the past year. Thus the gross sales of the company, as compared with 1907, decreased $274,706,928, or 36.3 per cent.; while the net earnings, after deducting all general and operating expenses, depreciation and renewal funds, were diminished by $69,116,963, or 42.9 per cent. Dividends on the preferred and common stock were continued in 1908, but the appropriations for additions to property and new construction—which were $54,000,000 in 1907, and the same amount in 1906—were omitted entirely last year. The surplus over all charges, from which appropriations were made, shows a decrease last year of $58,836,850, or 56.3 per cent. This proportion of decrease was naturally much greater than that in the net earnings, since the charges on the debt were not diminished, but showed some increase, chiefly due to the issue in 1907 of bonds for the purchase of the Tennessee Coal, Iron and Railroad Company stock.

The General Balance Sheet

The condensed balance sheet, reduced to its lowest possible terms, may be stated as follows:

Liabilities.	
Capital stock, preferred	$360,281,100
Capital stock, common	508,302,500
Capital stock, subsidiary companies, not owned	640,302
Total stock liabilities	$869,223,902
Bonded and debenture debts	593,231,209
Mortgages and purchase obligations	4,161,981
Current liabilities	43,031,854
Sinking, depre. and res. funds	64,879,360
Bond sinking funds	38,074,012
Undivided surplus	133,415,214
Total liabilities	$1,746,017,532
Assets.	
Property accounts	$1,474,142,655
Deferred charges	6,306,666
Outside investments	3,083,000
Sinking and reserve fund assets	23,263,035
Current assets	239,222,176
Total assets	$1,746,017,532

The stock accounts were unchanged last year; the bonded debt showed a net decrease of $7,454,957. The undivided surplus—$133,215,414—represents the working capital. The inventory valuation of materials on hand, included in current assets, amounted to $136,188,874 in the close of 1907, and $143,179,629 in 1908.

This condensed balance sheet exhibits the combined assets and liabilities of the United States Steel Corporation and of the several subsidiary companies, based on the valuations at which the stocks of the subsidiary companies and the Carnegie company bonds were acquired by the Steel Corporation; but liabilities from one company to another are omitted from both liabilities and assets. The outstanding capital stocks of subsidiary companies which are not held by the United States Steel Corporation show a net decrease during the year of $121,507. This results from the acquirement during the year by the corporation of an additional $158,405, par value, of Tennessee Coal, Iron and Railroad Company's stock, less the issue to outside holders of $36,897 of that company's stock purchased by them under subscriptions made prior to the date at which a controlling interest in the Tennessee company's stock was acquired by the corporation.

Capital Expenditures

The expenditures made during the year by all companies and properly chargeable to capital account, for the acquisition of additional property and construction, less credits for property sold, equaled $49,422,697. All of the above expenditures comprehend only actual additions and extensions to the plants and properties. The capital expenditures are classified by property groups as follows:

Gary, Indiana, plant	$18,733,841
Other properties: exclusive of Tennessee:	
Manufacturing	14,610,517
Coal and coke	1,938,402
Iron ore	3,103,966
Transportation	7,238,627
Miscellaneous	336,351
Tennessee Co. properties	3,460,993
Total for the year 1908	$49,422,697

In addition to the foregoing amount there was expended the gross sum of $7,453,158 for stripping the overburden from orebodies preliminary to mining ore from open pits, for additional logging equipment, etc. Against this charge was credited $1,813,611 for expenses of foregoing character absorbed in operating expenses for 1908 for mining ore and timber logged, leaving a net increase during the year in the amount invested in stripping outlays and logging equipment of $5,639,547. The total investment at Dec. 31, 1908, in these operations and carried in property account equals $15,936,929, all of which will be absorbed in operating expenses when respectively the ore thus uncovered is removed and timber is cut. Since April 1, 1901 (the date of organization), to Jan. 1, 1909, the amount expended by all companies for additional property and construction equaled a total of $255,497,987.

Income Account

The statements of accounts, statistics, etc., presented in this report comprehend, unless otherwise specifically stated, the combined results for the United States Steel Corporation and all of the subsidiary companies, including the Tennessee Coal, Iron and Railroad Company. A condensed statement of the income account for the year is as follows:

Net earnings for the year	$91,847,711
Sinking funds, subsidiary cos.	$1,588,071
Depreciation funds	3,844,214
Replacement funds	11,532,897
Interest on Steel Corp. bonds	23,862,647
Sinking fund Steel Corp. bonds	5,385,203
Total charges	$46,213,032
Net balance	$45,634,679
Add adjustment of accounts	94,035
Total surplus	$45,728,714
Dividends, preferred, 7%	$25,219,677
Dividends, common, 2%	10,166,050
Total dividends	$35,385,727
Undivided earnings	$10,342,987

No appropriations for new construction were made during the year. Such appropriations amounted to $54,000,000 in 1907.

A comparative statement of all receipts and disbursements for two years is given in the following table:

	1907.	1908.
Gross sales	$757,014,768	$482,307,840
Interest on investments	9,748,951	5,786,885
Total receipts	$766,763,719	$488,094,725
Operating expenses	$564,166,767	$367,735,102
General expenses	25,395,379	21,001,037
Subsidiary cos.' accounts	16,236,889	7,510,875
Total expenses	$605,799,045	$396,247,014
Net earnings	$160,964,674	$91,847,711
Interest and sinking funds	$27,719,744	$29,153,815
Depreciation and replacements	28,679,366	16,965,182
Total charges	$56,399,110	$46,118,997
Surplus	$104,565,564	$45,728,714
Dividends	$35,385,727	$35,385,727
New construction	54,000,000	.....
Total appropriations	$89,385,727	$35,385,727
Undivided profits	$15,179,837	$10,342,987

The gross sales represent the aggregate value of the commercial transactions conducted by the respective companies, and include sales made between the subsidiary

companies and the gross receipts of the transportation companies for services rendered both to subsidiary companies and the public. The earnings resulting represent the combined profits accruing to the several corporate interests on the respective sales and services rendered, each of which is in itself a complete commercial transaction.

Production

The production of the several subsidiary properties for the year 1908, in comparison with the results for the year 1907, is shown in the subjoined table. In order to make the comparison upon relatively the same basis, the production figures of the Tennessee company for the entire year 1907 have been included in the results shown below for that year. The figures are in tons, except cement, which is in barrels:

Products.	1907.	1908.
Iron Ore Mined	Tons.	Tons.
In Lake Superior ore region.		
Marquette range	1,170,496	830,087
Menominee range	1,625,358	1,021,598
Gogebic range	1,425,457	1,078,025
Vermilion range	1,724,217	927,206
Mesabi range	16,458,273	11,272,397
In Southern ore region.		
Tennessee Co.'s mines	1,576,757	1,533,402
Total	23,980,558	16,662,715
Coke Manufactured.		
Bee-hive ovens	12,716,013	7,591,062
By-product ovens	828,751	578,869
Total	13,544,764	8,169,931
Coal Mined, not used in making coke	3,550,510	3,008,810
Limestone quarried	3,201,222	2,186,007
Blast Furnace Products.		
Pig iron	11,234,447	6,810,831
Spiegel	130,554	74,716
Ferromanganese and silicon	57,794	48,861
Total	11,422,795	6,934,408
Steel Ingot Production.		
Bessemer	7,556,460	4,055,275
Open-hearth	5,786,532	3,783,438
Total	13,342,992	7,838,713
Rolled and Other Finished Steel Products for Sale.		
Steel rails	1,879,985	1,050,389
Blooms, billets, slabs, sheet and tinplate bars	761,195	551,106
Plates	894,364	312,470
Heavy structural shapes	587,954	313,733
Merchant steel, skelp, hoops, bands and cotton ties	1,338,833	577,591
Tubing and pipe	1,174,629	654,428
Rods	126,095	93,406
Wire and products	1,481,226	1,275,785
Sheets—black, galvanized and tinplate	1,070,752	770,321
Finished structural work	719,887	403,832
Angle and splice bars and other railjoints	195,157	84,669
Spikes, bolts, nuts and rivets	67,991	40,252
Axles	189,006	24,057
Sundry steel and iron products	77,463	54,893
Total	10,564,537	6,206,932
Spelter	31,454	28,057
Sulphate of iron	24,540	26,411
Universal portland cement, bbl	2,129,700	4,535,300

The total falling off in rolled and other finished-steel products—which is the final form in which the Corporation's products reach the buyer—was 4,357,605 tons, or 41.2 per cent.

Domestic and Foreign Trade

The decrease in domestic sales of all products last year was 41.9 per cent.; in foreign trade, only 21.2 per cent. The report says: "The export business constituted about 12.4 per cent. of the entire shipments of rolled and other finished-steel products. The average prices received for exported material of all kinds, while somewhat lower than were received in the preceding year, compared very favorably with the average for the domestic business. The advantage to both the manufacturer and the employees of the permanent establishment of a fair volume of foreign trade, especially during periods of lesser activity in the United States, was most forcibly illustrated during 1908. An essential feature necessary to the successful conduct of a foreign trade, and one that can be obtained only by remaining continuously in the business, is that the manufacturer, his grades of goods and his methods shall become known to the consumers. Otherwise the use of the foreign market is largely limited to the so-called 'dumping' process, which is only accomplished at profitless prices. In the domestic trade the prices received for steel products shipped in 1908 averaged substantially the same as those received in the preceding year."

Productive Capacity

The total expenditures for new property and construction since the organization of the Steel Corporation have been $348,032,939, including betterments. The effect is shown in the following statement of productive capacity in 1901 and at the close of 1908:

	1901.	1908.
Blast furnace products	7,440,000	14,990,000
Steel ingots	9,425,000	17,070,000
Finished iron and steel	7,719,000	12,900,000
Cement, bbl	500,000	6,100,000

This growth has not, however, done much more than keep pace with the general increase in the trade, as is shown by the following table, which gives the proportions of the total output of the United States furnished by the Steel Corporation and by other manufacturers in 1901 and 1908:

	1901.		1908.	
	U.S. Co.	Others.	U.S. Co.	Others.
Pig iron	43.2	56.8	43.5	56.5
Bessemer steel ingots	70.1	29.9	66.3	33.7
Open-hearth steel ingots	58.8	41.2	48.6	51.4
Total steel	66.2	33.8	56.4	43.6

The Steel Corporation has always been weakest on the pig-iron side. This will be remedied by the new furnaces at Gary. The Gary plant will also increase the proportion of steel to the total output of the country.

Employees of the Corporation

The average number of employees at all plants during the year was:

	1907.	1908.	Changes.
Manufacturing	151,670	118,557	D. 33,113
Coal and coke	21,447	17,164	D. 4,283
Iron ore	16,462	13,135	D. 3,327
Transportation	18,133	14,165	D. 3,968
Miscellaneous	2,468	2,190	D. 278
Total number	210,180	165,211	D. 44,969

The total amount paid in wages and salaries was $160,825,822 in 1907, and $120,510,829 in 1908; a decrease of $40,314,993.

The average payment per employee was $765.19 in 1907, and $729.44 in 1908; a decrease of $35.75 last year.

In January, 1909, there was offered to the employees of the United States Steel Corporation and of the subsidiary companies the privilege of subscribing for 18,000 shares of preferred stock and 15,000 shares of common stock at the price of $110 per share for the former and $50 per share for the latter. The conditions attached to the offer and subscription were substantially the same as those under which preferred stock had been offered in each of the previous six years, excepting as to the subscription price. Moreover, because of the lower price at which the common stock was offered, as compared with the price for the preferred, the special bonus to be paid subscribers who retain their stock for five years was fixed for the common shares at one-half the amount of bonus which is to be received by holders of preferred shares. Subscriptions were received from 19,192 employees for an aggregate of about 23 per cent. in excess of the amount of stock offered. Subscriptions were reduced *pro rata*, except that employees subscribing for stock equaling a value at the subscription price of $110 or less per employee, were allotted the full amount subscribed for. The total number of shares allotted was 18,000 of preferred and 15,318 of common stock. At Dec. 31, 1908, there were 22,960 employees who had purchased preferred stock under offers made by the Corporation, and who on that date either held the certificates of stock or were making monthly payments on account of the purchase price thereof.

Transportation Properties

The railroads worked by the Corporation include 873 miles main line and 575 miles branches and spurs owned, and 435 miles leased; a total of 1883 miles, on which there are 304 miles of second track and 754 miles of sidings. The equipment owned includes 960 locomotives and 45,682 cars. The transportation equipment on the Lakes includes 76 steamships and 29 barges. In connection with these there are owned large shipping docks at Two Harbors and Duluth on Lake Superior, and receiving docks at several Lake Erie ports.

General Improvements

Notwithstanding the industrial depression, new work of considerable magnitude was authorized during the year, principally by the coke properties, to provide the added fuel requirements called for by the additional furnaces completed and nearing completion at Gary, Carrie, Duquesne and

Youngstown; by the iron ore properties in opening and developing mines in order to supply the increased ore tonnage required by these additional furnaces; the increase in the lake transportation facilities by the purchase of two additional 11,000-ton ore steamers; and by the Tennessee company in opening new ore mines and rehabilitating and enlarging the capacity of its blast furnaces. There was also commenced near the close of the year an extension of the cement plant at Universal, Penn., which will increase the daily capacity of this plant from 4000 to 10,000 bbl. With the completion of this extension the annual capacity of the cement plants operated by the Universal Portland Cement Company—a subsidiary company—will be 8,200,000 bbl. of Universal portland cement. In the year 1908 there were shipped to customers 4,138,757 bbl. of cement, against 2,322,875 bbl. in 1907. This increase was made possible through the completion and placing in operation late in 1907 of plant No. 4, at Buffington, Ind., and plant No. 5, at Universal.

At the close of the year there were unexpended on appropriations authorized for construction and improvement purposes the following sums: For all properties exclusive of Gary, $28,200,000; for Gary, $22,500,000; total, $50,700,000. It is estimated that about 75 per cent. of this total will be used during the current year.

Open-hearth Steel

During the last 18 months the subsidiary companies of the Corporation have increased their open-hearth steel capacity by 3,052,000 tons. This includes 500,000 tons of steel capacity controlled by the Tennessee company. During the same period the bessemer steel capacity of the subsidiary companies was reduced—by reason of substitution of open-hearth for bessemer—by 746,000 tons, leaving a net increase in the total steel capacity of 2,306,000 tons, of which 1,806,000 tons resulted from enlargements of old plants and the new plant at Gary, and 500,000 tons by the addition of the Tennessee company.

The Gary Plant

All of the construction work on account of the manufacturing plant at Gary, Ind., the city of Gary and the terminal railroad work adjacent thereto was carried on continuously and actively during the past year.

At the manufacturing plant four of the blast furnaces have been completed, three being now in operation. The first pig iron was produced on Dec. 21, 1908. The remaining four blast furnaces now under construction will be completed during the year 1909. Of the 56 open-hearth furnaces authorized to be constructed, one unit of 14 furnaces is completed, another unit of 14 furnaces is nearing completion and a third unit of 14 furnaces will be completed during the current year. Several open-hearth furnaces in the first unit are now in operation, the first steel having been produced on Feb. 2, 1909. The rail mill is completed and is now in operation, the first rail having been rolled on Jan. 24, 1909, from steel ingots supplied from other plants. The billet mill will be completed by July 1, 1909. Construction work on the 160-in. plate mill, on a group of merchant mills and on the car-axle plant is well under way, the expectation being that all of these finishing mills will be completed and in operation before the close of the present year. A full complement of mechanical shops, including machine shop, foundry, pattern shop, blacksmith shop and roll shop, together with necessary equipment and machinery, has been completed and the several shops are now in operation, furnishing economical facilities for aiding in the general construction work and in the operation of the plant. The vessel slip and docks, including ore-handling apparatus, have been completed. The ore docks have a capacity for handling and storing 2,000,000 tons of iron ore. The organization of the operating force has been developed as the several mill departments have approached completion and at the present time the plant is in readiness to produce pig iron, steel ingots and open-hearth steel rails.

The Iron and Steel Tariff

The bill submitted to Congress by the Ways and Means Committee makes many reductions in iron and steel duties. Iron ore is placed on the free list. The other proposed rates on principal items are shown below, in comparison with the present rates:

	Present Tariff.	New Law.	Change.
Pig iron, per ton.	$4.00	$2.50	D. $1.50
Scrap iron and steel, per lb.	4.00	0.50	D. 3.50
Bar iron, lb.	0.008	0.004	D. 0.004
Small bars, rounds, etc., lb.	0.005	0.004	D. 0.001
Charcoal bars and rods, ton	12.000	6.000	D. 6.000
Cold rolled bars, additional, lb.	0.0025	0.00125	D. 0.00125
Structural shapes, lb	0.005	0.003	D. 0.002
Plates, over No. 10 gage, lb.	0.005 to 0.01	20%	.....
Sheets, under No. 10 gage, lb.	0.007	0.005	D. 0.002
Sheets, under No. 20 gage, lb.	0.008	0.006	D. 0.002
Sheets, under No. 25 gage, lb.	0.011	0.008	D. 0.003
Sheets, under No. 32 gage, lb.	0.012	0.009	D. 0.003
Polished sheets, lb	0.020	0.0175	D. 0.0025
Steel ingots and blooms	0.003 to 0.047	0.00175 to 0.046	D. 0.00125 to 0.001
Rails, lb.	0.0035	0.00175	D. 0.00175
Rail joints, etc., lb	0.004	0.002	D. 0.002
Tin plates, lb.	0.015	0.012	D. 0.003
Wire nails, lb.	0.005	0.0025	D. 0.0025
Cut nails, lb.	0.006	0.005	D. 0.001
Loco. and car wheels, lb.	0.015	0.0125	D. 0.0025

A maximum and minimum feature is incorporated in the bill by the introduction of a special section which, in the case of metal products imported from countries which do not grant their minimum tariff to American goods, levies a retaliatory additional duty of 20 per cent., except as to pig iron and car wheels, upon which the retaliatory rates shall be the rates of the Dingley act.

The definition of steel in the bill is as follows: "All metal produced from iron or its ores, which is cast and malleable, of whatever description or form, without regard to the percentage of carbon contained therein, whether produced by cementation, or converted, cast, or made from iron or its ores by the crucible, bessemer, Clapp-Griffith, pneumatic, Thomas-Gilchrist, basic, Siemens-Martin, or open-hearth process, or by the equivalent of either, or by a combination of two or more of the processes or their equivalent of any, or by a combination of two which produces from iron or its ores a metal either granular or fibrous in structure, which is cast and malleable, excepting what is known as malleable-iron castings, shall be classed and denominated as steel."

Proposed Tariff Changes on Metals

Changes in the duties on metals, as proposed in the tariff bill recently introduced are given in the table below. Of course, material alterations may be made before the bill passes:

	Present, Cents.	New Law, Cents.	Change, Cents.
Lead in ores, lb.	1.500	1.500	.....
Lead in metallic form, lb.	2.125	1.500	D. 0.625
Lead in manufactures, lb.	2.500	1.875	D. 0.625
Zinc, metallic, lb.	1.500	1.000	D. 0.500
Zinc sheets, lb.	2.000	1.250	D. 0.750
Zinc in ore, lb.	free	1.000	.....
Antimony, metal, lb.	0.750	0.750	.....
Nickel and nickel oxide, lb.	6.000	6.000	.....
Quicksilver, lb.	7.000	7.000	.....
Aluminum, lb.	8.000	7.000	D. 1.000
Aluminum, sheets, etc., lb.	13.000	11.000	D. 2.000

Duties of 2.5c. per lb. are provided for on copper sheets, rods, tubes and other manufactured forms; and of 2c. per lb. on sheathing or yellow metal.

Queensland Gold

Gold production in Queensland in February is reported at 32,500 oz. fine, including 5200 oz. from copper ores. For the two months ended Feb. 28 the production was 57,000 oz., or $1,178,190. Of this total only 900 oz. was from placers.

The coal output for Natal during December, 1908 (*So. African Min. Journ.*, Jan. 23, 1909) was 60,837 tons bunker coal and 49,012 tons exported, a total of 109,849 tons.

The New Tariff Bill

SPECIAL CORRESPONDENCE

The Payne tariff bill was introduced in the House of Representatives March 17, was referred to the House Ways and Means Committee and was reported by that body on the morning of March 18, after 10 minutes of discussion. The bill is accompanied by a report from Chairman Payne summarizing the measure and pointing out the reasons for attempting a revision of the tariff at the present time. Discussion was begun in the House on the morning of March 22.

Notes of the principal proposed changes in the metal and the iron and steel schedules were published in the JOURNAL of March 20, and elsewhere in the present issue.

MAXIMUM AND MINIMUM RATES

The special characteristic of the Payne bill, differentiating it from the tariff measures that have preceded it, is that it provides a maximum and minimum schedule of duties, the latter to become effective at once upon the enactment of the bill, the former to go into effect against such countries as refuse to give our exports entering their ports rates as favorable as those accorded to the goods of any other country. These maximum rates apply to practically all of the items enumerated in the metal schedule. To the items enumerated in 41 of the 80 paragraphs in the metal schedule the Dingley rates in force prior to the passage of the new tariff would be applied as the maximum, while to the rest maximum rates 20 per cent. higher than the minimums mentioned in the proposed new schedules would apply. Those which would take the Dingley rates are chiefly the manufactures of iron and steel, hardware, and the like. Those which would take the advance of 20 per cent. over the minimum, would include lead, zinc, the ferro-alloys, metallic mineral substances in a crude state and some machinery.

DRAWBACKS ON MANUFACTURES EXPORTED

The drawback section is acceptable to metal-manufacturing interests as it will permit the substitution of equal quantities of imported material in exported manufactured products, instead of requiring as at present the absolute identification of the materials entering into each product.

SMELTING IN BOND

Special criticism is offered regarding the provision for smelting in bond, which is less satisfactory than the old one, notwithstanding the efforts to secure a liberalization of the requirements of the law. The section in question is No. 28, and reads as follows:

"SEC. 28. That the works of manufacturers engaged in smelting or refining metals, or both smelting and refining, in the United States may be designated as bonded warehouses under such regulations as the Secretary of the Treasury may prescribe: *Provided,* That such manufacturers shall first give satisfactory bonds to the Secretary of the Treasury. Ores or metals in any crude form requiring smelting or refining to make them readily available in the arts, imported into the United States to be smelted or refined and intended to be exported in a refined but unmanufactured state, shall, under such rules as the Secretary of the Treasury may prescribe, and under the direction of the proper officer, be removed in original packages or in bulk from the vessel or other vehicle on which they have been imported, or from the bonded warehouse in which the same may be, into the bonded warehouse in which such smelting or refining, or both, may be carried on, for the purpose of being smelted or refined, or both, without payment of duties thereon, and may there be smelted or refined, together with other metals of home or foreign production: *Provided,* That each day a quantity of refined metal equal to 95 per centum of the amount of imported metal smelted or refined that day shall be set aside, and such metal so set aside shall not be taken from said works except for transportation to another bonded warehouse or for exportation, under the direction of the proper officer having charge thereof as aforesaid, whose certificate, describing the articles by their marks or otherwise, the quantity, the date of importation, and the name of vessel or other vehicle by which it was imported, with such additional particulars as may from time to time be required, shall be received by the collector of customs as sufficient evidence of the exportation of the metal, or it may be removed under such regulations as the Secretary of the Treasury may prescribe, upon entry and payment of duties, for domestic consumption, and the exportation of the 95 per centum of metals hereinbefore provided for shall entitle the ores and metals imported under the provisions of this section to admission without payment of the duties thereon: *Provided further,* That in respect to lead ores imported under the provisions of this section the refined metal set aside shall either be reëxported or the regular duties paid thereon within six months from the date of the receipt of the ore. All labor performed and services rendered under these regulations shall be under the supervision of an officer of the customs, to be appointed by the Secretary of the Treasury, and at the expense of the manufacturer."

PATENT PROVISIONS

Sharp dissatisfaction has been expressed with the provision of the bill which includes the plan for discrimination against foreign countries that attempt to subject our patents to unfair treatment. This provision is found in Section 41 and reads as follows:

"SEC. 41. That whenever a patent is issued by the United States to any citizen or subject of a foreign country it shall be subject with respect to manufacture thereunder in this country to all the limitations, conditions and restrictions that are imposed by the country of said citizen or subject upon the manufacture in that country under patents issued therein to citizens of the United States."

Transvaal Gold

Gold production in the Transvaal in February is reported at 550,645 oz. from the Witwatersrand and 14,573 oz. from the outside district; a total of 565,218 oz. This is a decrease of 49,995 oz. from January, which was due entirely to the shorter month; the daily average having been 19,842 oz. in January and 20,183 oz. in February. For the two months ended Feb. 28 the total was 1,102,258 oz. in 1908, and 1,180,331 oz.—or $24,397,442—in 1909; an increase of 78,073 oz. this year.

The labor report shows an increase of 7174 Kafirs in February, and a decrease of only 11 Chinese; the total number on Feb. 28 being 157,838 Kafirs and 10,034 Chinese.

The February report includes 69 mines, the mills having 8930 stamps in all. The total ore crushed during the month was 2,338,991 tons, and the general average result was $10.43 per ton.

Indian Gold Mines

The production of the Kolar district in Mysore, India, in February was 40,076 oz. bullion, being 5238 oz. less than in January and 2361 oz. less than in February, 1908. The decrease was due to a fire in the Nundydroog mine. The total for the two months ended Feb. 28 was 86,340 oz. bullion in 1908, and 85,390 oz. in 1909; a decrease of 950 oz. The bullion reported this year was equal to $1.588,570, or 76,851 oz. fine gold.

The output of the two producing mines in the Deccan—the Hutti Nizam and the Dharwar Reefs—was 2083 oz. in February. For the two months ended Feb. 28 it was 3317 oz. in 1908 and 4131 oz. in 1909.; an increase of 814 oz. this year.

Wherever considerable ore is trammed, all turn sheets should be eliminated and curves used, for most up-sets occur at such points, and, besides, slewing a truck is hard work and many times an avoidable loss of energy.

The Saint Croix safety-catch device, which is designed to stop the cage gradually and independently of the guides, is being tried at the Marcus shaft of the Langlaagte Estate, South Africa.

Colliery Notes

All safety lamps should be carried steadily and not jerked or held in a slanting position.

It is estimated that the world contains 200,000 square miles of peat bogs, while of this total area, 36,000 square miles are located in the United States. Canada is credited with 37,000 square miles; Germany, 10,000 square miles, and Ireland 1100 square miles.

Recent estimates place the original supply of coal in Indiana at 44,169,000,000 short tons. The aggregate production of coal in Indiana to the close of 1907 amounted to 159,440,390 short tons, of which 13,985,713 tons, or practically 9 per cent. was produced in 1907. The exhaustion represented by this production is figured at 239,000,000 tons or 0.54 per cent. of the original supply. The coal remaining in Indiana is, therefore, nearly 300 times the production at the close of 1907.

In coaling a large steamer in a Japanese port, about 600 persons are employed. The coal is placed in small baskets, holding a trifle more than a peck, and is passed along the line until it reaches the ship. It takes these 600 people just seven hours to load a steamer with 1500 tons of coal. They receive for this work about 20c. each, in American money, making the cost of coaling the ship about $120. The work could not be accomplished for much less by machinery.

The practice of robbing one or two pillars at varying intervals of time, is most ill-advised. Robbing should not be started until a certain district, comprising say eight or ten pillars, has been prepared for quick drawing. All of the pillars should be brought back together as uniformly and quickly as possible. This plan insures the pressure being brought to bear equally on each pillar, and besides bringing the coal down in larger lumps, causes the roof to subside evenly, preventing a loss of coal through a squeeze.

In firing a furnace, it is best to have the coal broken to a size no larger than a man's fist. The reason for this is, that large lumps do not ignite promptly, and their presence also causes holes to form in the fire, which allow the passage of too much air. Do not land the coal in a heap, but spread it over as wide a space as possible. Fire one side of the furnace at a time, so that the other side containing a bright fire will ignite the volatile gases from the fresh charge. Carry as thick a fire as the draft will allow. Fire little and often, rather than heavy and seldom. In case of a sudden interruption in the amount of steam being used, it is best to regulate the draft by the bottom or ash-pit doors rather than by the stack dampers; when the latter are used, it tends to produce a smoky chimney.

We of the United States, are not alone in our troubles over the questions of labor and wages. In Germany, there is a popular demand for a reduction in the price of coal, and the mine owners reply that such action is impossible owing to the high wages paid miners. The German miners last year earned approximately $1.50 a day and other workers in the mines about $1. These rates were an increase over those of 1905 of about 26 per cent. for the miners, 20 per cent. for other workers underground and 14 per cent. for laborers. German mine owners are now confronted by a number of new laws which will require them to pay a total of about $2,500,000 for the purpose of invalid and accident insurance. To this same fund, the mine workers are required to contribute a similar sum.

Among the new rules to govern the coal industry in Ohio, the mine inspectors have prescribed the following: (1) No wires carrying current shall be extended beyond the outside corner of the last breakthrough between entries or rooms. (2) In no case shall an electric wire be attached to a pipe-line in any mine, and all pipe-lines must be protected from contact with bonded rails or wires used for conducting power for motor haulage or any other purpose. (3) All ventilating fans operated by electricity shall have a direct wire from the generator. (4) No running switches shall be made, either by haulage or gathering motors, where men are traveling in or out in mines. (5) No person shall be permitted to ride on loaded cars or motor, or high-speed haulage trips, unless a special trip is run for the purpose of taking employees in and out of the mine.

In striking contrast to the laxity of our employers' liability laws is the policy of foreign countries, 22 of which have enacted legislation recognizing the principle that the workman is entitled to compensation for injuries from accidents received in the course of his employment. There is variation in the provisions of the foreign laws, but as a general rule, compensation is not payable unless the injury causes disablement for a specified number of days or weeks. The employer may usually be relieved from the payment of compensation if he can prove that the injury was caused intentionally or by wilful misconduct; however, in none of these 22 countries does ordinary negligence on the part of the injured employee work a forfeiture of the right to compensation. In all the countries with the exception of Sweden, the compensation is based upon the wages of the injured person. The acts of nearly all of the countries are framed with a view of obviating the necessity for instituting legal proceedings. Agreements, therefore, are usually made amicably between the employers and the victims of an accident.

The plan of heating the air forced into a mine, for the purpose of raising the humidity, especially in winter time, must be accompanied by an efficient system of putting a large amount of moisture into this air. Up to the present time, the means generally employed for accomplishing this end have been rather primitive, so that it is interesting to note that a system originating in Germany and meeting with much success there, has been introduced into this country. This general scheme consists of mechanically spraying in a fine mist form through a number of specially constructed spray nozzles. The construction of these nozzles is such that when water is forced through them under a pressure of from 50 to 100 lb., it issues forth in the form of a mist without any drops. The nozzles are distributed at intervals in the air shafts and entries through which the air currents pass, and the full discharge from the nozzles is instantly caught up by the current of air and is carried to the remotest corners of the mine; this plan keeps the walls, roof and floor of the mine moist. The system being introduced is known as the Koerting spray system, and the nozzles are being manufactured by the Schütte & Koerting Company, Philadelphia, Pennsylvania.

The question of a proper capping for a winding rope is important. The former practice of turning the wires back in order to form the bulge for the capping to grip has resulted in many accidents of cage falling to the bottom of the shaft. The later scheme of having the wires of the rope gripped within a cone of white metal has proved satisfactory at a number of collieries. Close attention should be given to see that this latter method is properly carried out. The following points are essential to remember: 1. Bind the rope with soft iron wire, at the point at which it is to be opened out. 2. Carefully straighten the wire; open out each wire and straighten the strand curves, so that the wires cannot possibly twist together again. 3. Thoroughly clean each wire, taking off all grease and dirt close up to the wire wrapping. 4. Thoroughly dust the wire with resin dust so that the fluid white metal will freely flow around each wire. 5. After drawing the wires down into the steel socket, a hemp or cloth wrapping may be used to prevent the metal running out. Do not put the socket into use if the white metal does not show outside the steel socket. One of the best mixtures of white metal is the following: Lead, 60 per cent.; tin, 30 per cent.; antimony, 9 per cent.; bismuth, 1 per cent. The antimony adds to the hardness, the bismuth lowers the temperature of fusion and gives a slight expansion in cooling. It is advisable to never remelt and use the same metal a second time. There is no truth in the statement that the hot fluid metal affects the temper of the wires of the rope.

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Illustrated.

The Steel Corporation Report

The report of the United States Steel Corporation covers such a wide range of interests and deals with such large figures that it requires much study and careful analysis to get at its full meaning. Not that it is obscure or involved; the present report, like its predecessors, is a full and fair statement of the business transactions of the year. No attempt has been made to cover up the depression in business which marked the period under review, or to disguise the losses of business in comparison with previous years. How great those losses were can be illustrated by a few figures. Thus the gross sales, while approaching very nearly $500,000,000 in amount, were less than those of 1907 by $274,706,928, or 36.3 per cent. The net earnings, after deducting all working and general expenses, depreciation and ordinary renewals, decreased $69,116,963, or 42.9 per cent.; while the surplus over all charges—the final net profit—was diminished by $58,836,850, or 56.3 per cent. The higher proportion of loss in the final net surplus is explained by the fact that the interest and fixed charges are practically the same in a lean business year as in a good one. Perhaps the remarkable point is that with a loss of over one-third of the gross earnings the surplus for the year should have been sufficient to pay the usual dividends, without drawing upon the company's accumulated profits.

The loss in earnings was due entirely to smaller business, since the report tells us that there was little change in the prices realized. What the reduction was is shown by the table of production which notes decreases of 31.7 per cent. in the make of pig iron; 41.2 in steel ingots, and 41.3 in finished iron and steel. The tables are not carried far enough to make statements of average returns and costs practical. A rough determination may be made, however, by taking the quantity of finished iron and steel products, which are the forms in which by far the greater part of the Corporation's output reaches the consumer. On this basis the gross earnings of 1907 show an average of $71.65 per ton, and the net earnings $15.24; the figures for 1908 being $77.71 and $14.80 per ton. These averages are, of course, too high, as they disregard the sales of steel billets and other half-finished forms, and of by-products, like copperas, cement, etc.; but they will serve some purposes of comparison.

As already noted, the final net earnings were sufficient to continue the payment of dividends at an unchanged rate; but the Corporation suspended for the year the appropriations for new construction—that is, for actual additions of property, as distinguished from renewals and the making good of depreciation. Such appropriations in 1906 and 1907 amounted to $54,000,000 in each year. Since its organization the Corporation has spent for such additions a little over $348,000,000, the effect of which has been to double its pig-iron production, to increase its capacity for making steel about 80 per cent. and for finished forms 67 per cent. This has been a wise policy; indeed, a necessary one, if it was to maintain the position in the trade. After all, the additions did not do more than keep pace with the general growth in capacity for making iron and steel. In 1908 the proportion of the total output of the United States furnished by the Steel Corporation was very nearly the same as in 1907.

The report deals fully with the financial side of the year's operations, but has little to say of technical matters, or technical progress. One statement of interest, however, is that while the open-hearth steel capacity was increased during 1908 by 3,052,000 tons yearly, the bessemer-steel capacity was decreased by 746,000 tons, owing to the substitution of open-hearth furnaces for converters.

Another proof of the diminished business of the past year is found in the fact that the average of 210,080 employees in 1907 was reduced by 44,969, to 165,211 men in 1908. The Corporation has continued its policy of placing stock with its employees, and at the end of 1908 had 22,960 who were owners of preferred stock.

Very little is said of iron-ore holdings, the subject being apparently avoided, notwithstanding—or perhaps because—of the recent active discussion of the question of iron-ore supplies and their ownership. The only reference is the statement that prospecting and preparation for increased production from the Mesabi properties were actively carried on, though the output last year was less than for three years preceding.

Upon the whole the report is rather better than might have been expected, and is to be commended for its fullness.

There is not space here to discuss the question whether its showing would have been different had the Corporation adopted earlier the economic policy to which it has at last been driven. Little or no attempt is made to discuss or defend that policy in the report itself.

Coal Mining as an Investment

Not for many years has the coal-mining industry been so completely enshrouded in a cloud of despondency as at present. Those who are financially interested in the production of coal are dubious as to how they are going to come out, and the more timid, either from inexperience or from short memory, are predicting dire results for the industry. When prices are high and consumption is breaking all records, eyes are shut to the recessions that will come, and similarly during a period of depression, some fear that the days of plenty have permanently forsaken them.

Some prominent operators are now thinking that there will be no improvement in the situation, unless there is a radical change in the conditions that govern the industry. They reason that new mines are being opened in such numbers that production is certain to exceed demand, even when business again reaches the prosperity of 1906-07. It is further asserted that coal mining is disorganized, and that this condition will prevent business from being brought to a profitable basis; also that each independent operator endeavors to mine and market his maximum production, undercutting his neighbor and thus spoiling his own market.

In all times of depression, the same cry has been raised and the prospective investor has been deterred from accepting the bargains presented. Immense fortunes have been made in coal, great profits yet await those who get in on the ground floor, and no well-made investment is surer of greater safety of principal and income than coal mining. The product cannot well be stored in large quantities, which fact alone prevents any great overproduction, while the independent competition in the industry prevents the maintenance of false price standards, such as have prevailed in the steel industry to the detriment of early business resumption.

How many branches of business made a better showing in 1908 than coal mining? Although the production in 1908 was only 88 per cent. of that in 1907, we mined nearly as much bituminous coal in 1908 as was produced in 1906 (a banner year), while the anthracite output in 1908 was considerably larger than in 1906. The average price received at the mines during the last decade has varied but little, and this has been true without there having been any monopolistic control of trade. The recessions have been dictated by commercial conditions, and have always resulted in stimulating rather than in upsetting business.

The production of coal is like a manufacturing business, and the industry as a whole is less speculative than many important industrial undertakings. As in other enterprises, the percentage of profit in coal mining depends on the sagacity of the investor in selecting his opportunity. It is not enough to know that the coal is of superior quality and that from every physical aspect, the venture is meritorious; it is also essential that the investor should be sure of his market. Many inferior seams show greater profits, because of their nearby markets and cheap transportation, than others which produce a superior fuel, but less favorably situated.

The disfavor with which many Eastern capitalists view coal mining is principally due to the exaggerated value placed on some properties that have recently been gathered into important consolidations. The stock of these companies has been sold at a price only justified by earnings during times of great prosperity and maximum production. Investors who have been persuaded to buy into these overcapitalized companies have naturally condemned the whole industry as unprofitable because of their own lack of understanding.

For the man whose judgment is sound and vision is keen, coal mining offers attractive opportunities. The cry of overproduction is no more serious now than it was in 1902, and along with improved methods of mining, that not only insure cheaper production, but also a greater percentage of recovery, the prices paid per ton at the mines are higher now than in 1902. It is to be admitted that labor and material now cost more, but the slight increase in them is offset by the advance in the art of mining, which now enables a recovery of 90 per cent. or more as compared with 70 or 80 per cent. a few years ago.

The Proposed New Tariff

In the bill brought in by the Ways and Means Committee on March 17 the changes of most interest to the mining industry are those affecting iron and steel, lead and spelter, and the ores of those metals. Iron ore on the free list will be of great advantage to the independent steel makers on the seaboard, which have been obtaining Cuban ore. It will enable them to produce pig iron materially cheaper, which ought to be to the advantage of consumers, without adversely affecting any domestic iron-mining enterprises of consequence. The removal of the duty on pig iron and the principal steel products will hardly lead to any increase in the importation thereof at the present time. The effect will be rather to restrain the rise of domestic prices at another boom period.

The changes proposed as to lead and zinc are likely to be disturbing. If we may judge from the range of prices during the last 10 years, lead could have been frequently imported at a payment of a duty of 1½c. per lb. At present prices it could not be profitably imported, and this will probably be always the case when lead at New York is 4 to 4½c., which is not much below the normal of the market. The chief effect of the reduction in the lead tariff also will be to restrain an excessive rise of prices. It has been erroneously reported, by ourselves included, that the tariff on lead in ore is to be reduced to 1c. per lb. It had been so reduced, but at the last minute, after Mr. Payne's statement had been given out, the old rate was restored.

The proposed change in the tariff on zinc and zinc ore will increase the cost of raw material to the smelters, while they will be deprived of part of their protection against foreign producers. The effect of this tariff will be to raise the price of spelter, which is what the advocates of the tariff on ore desire to do.

It is to be remarked that the bill before Congress at present is only a proposal, and it will be a long time to its introduction and enactment, during which many changes may be made, wherefore the final act may bear but little resemblance to that which is now proposed.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Extraction of Zinc from Mixed Ore

On account of the mixed character of the ore which I have had to smelt during the last three years, containing an average, without selecting, of about 3 per cent. copper, and 20 per cent. zinc as sulphide with considerable silver and gold (the remainder being made up of 18 per cent. heavy spar, 18 per cent. sulphur, 12 per cent. iron, 15 per cent. carbonate of lime, 8 per cent. silica and 2 per cent. lead) I have been investigating the different methods of zinc extraction from such ore and have come to the conclusion that the leaching process with ammonia in connection with carbonic acid, after the ore is roasted and reground, is the most suitable for our ore; and if so is suitable for any zinc ore containing sufficient value.

The ammonia does not seem to dissolve anything in the ore except the copper and zinc. Our chemist extracted 99 per cent. of the copper from a rich piece of chalcopyrite and about 80 per cent. of the zinc from a sample of zinc sulphide sent him from Arizona, which he did not have ground fine enough; better yet it should be slimed.

We expect to put in a suitable plant to roast the ore properly, regrind to the most suitable fineness, leach out the copper and zinc, siphon and filter off the solutions, and recover the ammonia by distillation, same as in an ice-manufacturing plant. This throws down the zinc and copper precipitate as the ammonia leaves the solution. (In this connection I may state that I precipitated the copper from the solution first with metallic zinc which would have thrown down any gold or silver at the same time if cyanide solution had been added to have extracted them; the equivalent of zinc dissolved to precipitate the copper is recovered with the remainder of the zinc).

I have extracted 73 to 80 per cent. of the zinc from a sample of our flue dust without any regrinding or preliminary preparation of any kind. After roasting and leaching out the zinc, the remaining pulp is much sweeter to smelt, but our chemist claims that the gold and silver can be extracted at the same time by adding calcium cyanide (a very cheap salt one-sixth the value of potassium cyanide) which can be practically used only in connection with ammonia. I think he is right but I have not experimented with it myself.

I have never heard of the ammonia process being tried on a large scale, except at a small plant in Nevada which I understand was a failure on account of lack of capital, and it did not have a continuous still for boiling out the ammonia. This process appeals to me for the reason that after crushing and roasting (any process to recover zinc requires this) it needs but very little power, the solvent ammonia is recovered and the product is pure, suitable for zinc white paint, or it can be reduced to metal. All the other processes require too much acid, which not only dissolves the zinc and copper but other elements at the expense of the acid, making it more difficult to produce pure zinc and too expensive.

I have spent considerable time and money with an electrician trying to produce marketable zinc at a profit with electricity in connection with different acids, and not only found that the chemicals, anodes and power were too expensive, but the zinc produced was not of first class.

The ammonia process, we estimate, will cost $6.60 per ton at a 50-ton plant 24 miles from the Southern Pacific railroad in California. This will cover drying, crushing, grinding, roasting, sliming, gas, ammonia, cyanide, lime, boiling-out still, calcining zinc oxide and producing enough metallic zinc dust to precipitate the copper and precious metals.

S. E. BRETHERTON.

San Francisco, Cal., March 18, 1909.

Has the Value of Gold Depreciated?

I have read with much interest the article by Mr. Ingalls in the JOURNAL of Nov. 28, 1908, and feel convinced that there is a good deal of truth in his ideas. Nevertheless I object to his comparing the world's gold production with that of pig iron, or any other article of general use that might be chosen for the purpose. Pig iron is consumed, and gold is not, at least to a large extent it is not. I intend to say, that this year's production of iron after a few months may be considered no longer to exist; it will be consumed and practically annihilated. The loss of gold, on the other hand, is confined to the wear of currency and to the amount used in the arts, but all the rest *joins the world's treasure;* it can be used again and again and will *remain to be available for financial purposes* for centuries to come.

I therefore believe, that diagram II, showing the yearly productions of gold and iron, does not fully answer its purpose, and I should like to have it completed by a third curve, in which the proper proportion of each year's gold production is added to the total amount, available at the beginning of that year. I understand quite well, that such a curve would by no means be an easy thing to plot; a suitable beginning point must be assumed and it will be necessary to find out just what amounts were coined and stored in banks each year, the remainder being used for other than financial purposes. And even if one should succeed in tracing that curve, it would not give an accurate idea about the question, since it is probable that vast amounts of coined metal continually pass out of circulation and are hoarded, especially in Asiatic countries.

I believe the truth lies in the interval between the curves plotted and the one I propose, but perhaps nearer to the latter. If considered from this point of view, is not the accumulation of precious metal in circulation faster nowadays than even the growth of industry and commerce?

I should be very pleased if Mr. Ingalls would express his opinion as to this in the JOURNAL.

A. C. DE JONGH.

Ma-Aman, Sumatra, Jan. 24, 1909.

It would be practically impossible, I believe, to plot such a curve as Mr. de Jongh suggests; even if it were, I do not think the result would justify the labor that would be involved. Iron does not cease to exist when it goes into use until it disappears by decay or is otherwise actually lost. Buildings, ships and many constructions are bought and sold directly, or through the stocks and bonds that represent them. They are forms of wealth and gold is the medium of exchange in the barter thereof. How would the world with its present wealth get along with the gold supply of 50 years ago? Wealth and gold supply are both cumulative, save for loss and destruction. The loss of gold and its industrial uses appear to be greater than is commonly supposed. According to Professor de Launay, in his recent book "The World's Gold," the world should have had (at the end of 1907) 2500 millions of pounds sterling of gold in hand, but certainly not more than 1200 millions was to be found in the state of coin, while between 1873 and 1904 alone more than 1360 millions of new gold money were struck. Half of the officially registered output has passed to industrial uses or has been lost. As to the general question of the effect of the recently greatly

increased gold production upon commodity prices, etc., Professor de Launay comes to substantially the same conclusion as I have done.

W. R. INGALLS.

New York, March 20, 1909.

Mining and Milling Florida Phosphates

In the JOURNAL of March 6, 1909, appeared an article entitled "Mining and Milling Florida Phosphates," by C. A. Stone. The statements made therein as to costs of mining, especially as regards that of hard rock phosphate should, I feel, be corrected in justice to the producers of Florida phosphate.

The cost of mining hard-rock phosphate is stated to be from $2 to $2.50 per ton; but to anyone conversant with this class of mining, or to any engineer who had made a careful study of the work in question, the figures given are wide of the mark. The cost of mining this class of rock, at a conservative estimate, is not less than $4.50 to $5 per ton. In addition thereto a number of the mines are operated under a royalty, varying from $1 to $1.25 per ton, payable to the land owners, which must be added to the actual cost of mining. The figures given by Mr. Stone would indicate that very large profits would accrue to the miners, even at existing low prices, whereas this is not the fact of the case when the true cost of mining is arrived at.

The cost of mining pebble phosphate is placed at $1.50 to $2.25 per ton. These figures are too low, and in my opinion, from long experience in this class of mining, should be advanced to $2.25 to $3 per ton, varying in accordance with the tonnage yield per acre, yardage of overburden to be removed, general efficiency of the mining installation as to power costs, etc.

The incorrect statements made as to cost of mining tend to do serious injustice to the Florida producers of phosphate, and should be corrected. There are a number of inaccuracies in connection with what might be termed the technical portion of this article, but these are of minor importance and hardly worthy of correction.

C. G. MEMMINGER.

Lakeland, Fla., March 12, 1909.

The Jeffrey Crab Locomotive

The article describing our new crab locomotive in the JOURNAL of March 13, was erroneous in the last paragraph, where it was said that this locomotive is not practical where the rooms are driven to the rise. As a matter of fact, this is one of its most practical features.

JEFFREY MANUFACTURING COMPANY

Columbus, O., March 15, 1909.

The Lick Branch Relief Fund

I herewith inclose you a circular which evidently has been sent to mining men or mining engineers. While I think I am as ready as anyone else to help in cases of suffering, it certainly seems to me that it is a little too much to ask outsiders to contribute to matters of this kind. All mining men and companies have their widows and orphans to look out for, and I should think that pride and common decency would suggest that a mining company should look out for its dependents, even to the point of using all of its assets.

If I remember correctly, at the time of the large explosion in Utah, in which 300 lives were lost, the company paid out $300,000 and did not say a word about it. Although I have every sympathy for the Lick Branch sufferers, it certainly seems to me that the Pocahontas Consolidated Collieries Company should either by itself, or along with its neighbors, make up this relief fund in full.

J. PARKE CHANNING.

New York, March 16, 1909.

[The circular to which Mr. Channing refers is issued by the "Lick Branch Mine Relief Committee," and recites the two explosions (Dec. 29, 1908, and Jan. 12, 1909) in the Lick Branch mine of the Pocahontas Consolidated Collieries Company, by which 117 lives were lost, leaving 53 widows and 76 children under 16 years without means of support. The company has paid for the burial of the victims and has thus far provided for the maintenance of the bereaved families, besides contributing $5000 to the fund which the committee is now seeking to raise.—EDITOR.]

A Project in the Choco Region, Colombia

It has come to my attention that an attempt is being made to interest capital in an enterprise based on the beds of the rivers Condoto, San Juan and Iro, of the Choco region, Republic of Colombia.

It would be well for the readers of the JOURNAL to bear in mind that there are good and valid titles existing, which have existed for some years, to the gold and platinum gravels of the beds and bars of these streams, including the dredging rights of their banks, subject, of course, to indemnification of agricultural injury. The taxes of these claims have been paid in perpetuity, and the rights obtained by them are indisputable.

When I learned of the fact that a dredging right covering some of this section had been granted I was in Bogota and protested to an official of the government. He at once called my attention to the fact that the dredging concession given was simply subject to all prior rights, and thus *ipso facto* was null and void regarding the region to which valid titles were in existence.

A word of explanation may be interesting. Real estate and mining titles are as safe in Colombia as anywhere on earth; but owing to the great area of the country it has been impracticable as yet to make a detailed survey on which all property should be located and geographically recorded at the time of granting title. Therefore, the central government is unaware of what titles may be existing, and grants such rights as are asked for by persons who make the pretension of intending to undertake active development, but always puts in a saving clause respecting prior rights.

It is an easy matter for anyone contemplating serious development of investment in Colombia to have investigations made in the local and departmental registries, and ascertain whether or no there are any previous titles in existence regarding tracts that they desire to obtain. Where the object, however, is not personal investment, but simply a stock-selling scheme, regarding which the promoter knows there is no legal basis, it is well for intending investors to be on their guard. I therefore give this word of warning.

HENRY G. GRANGER.

New York, March 16, 1909.

A Monument to John W. Powell

The sundry civil act for the fiscal year 1910, passed March 3, appropriates $5000 for a monument or memorial to John Wesley Powell, former director of the Geological Survey, to be erected on the brink of the Grand Cañon of the Colorado in the Grand Cañon Forest Reserve in Arizona, "in recognition of his distinguished public services as a soldier, explorer, and administrator of Government scientific work." The site for this proposed monument was suggested by Powell's memorable trips down the Grand cañon in 1869 and 1872—exploits of perilous venture that naturally appeal to men's sense of the hazardous and the heroic. The language of the act, however, recognizes the fact that Powell's more substantial achievements—his long directorship of the Geological Survey and his persistent championship of irrigation in the arid West when the cause of irrigation seemed hopeless—entitle him to the larger recognition due to the broad-minded scientific prophet working for great ends with courage and zeal to overcome not only popular indifference but narrow-minded opposition. Standing on the edge of the mighty chasm he first explored, his monument should recall not only the venturesome daring of the explorer, but the patient courage of the man of affairs who resolutely sets out, in spite of all obstacles, to achieve a great public work whose results shall endure through all time.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

MANUFACTURE—Improvements in the Manufacture of Aluminum. Henri Herrenschmidt, Paris. (Brit. No. 433 of 1908.)

BAUXITE

MANUFACTURE—Improved Process of Manufacturing Products for Refractory Ceramic or Abrasive Uses from Bauxite or Other Aluminous Earths. Erich von Seemen, Paris. (Brit. No. 702 of 1908.)

CALCIUM

MANUFACTURE—Improvements in the Manufacture of Metallic Calcium. Sherard O. Cowper-Coles, Westminster, Eng. (Brit. No. 24,396 of 1907.)

CEMENT

CEMENT CLINKER—Process of and Apparatus for Making Cement Clinker. Carleton Ellis, Larchmont, N. Y., assignor to Ellis-Foster Company, a Corporation of New Jersey. (U. S. No. 910,121; Jan. 19, 1909.)

HYDRAULIC CEMENTS—Art of Making Hydraulic Cements, etc. William H. Harding, Philadelphia, Penn. (U. S. Nos. 908,092; 908,093; 908,094; Dec. 29, 1908.)

KILNS—Improvements in or Relating to Rotary Kilns for Burning Cement. Friedrich J. Poths, Hamburg, Germany. (Brit. No. 13,440 of 1908.)

MANUFACTURE—Process for the Manufacture of Cement. Willoughby E. Synder, Nazareth, Penn. (Brit. No. 15,625 of 1908.)

COAL AND COKE

BRIQUET-MACHINE. Frank Burnes, St. Louis, Mo., assignor to American Fuel Company, St. Louis, Mo., a Corporation of Arizona. (U. S. No. 915,332; March 16, 1909.)

BRIQUETTING—Process of Briquetting Coal and the Waste Materials Thereof. George B. Damon, Glenside, Penn. (U. S. No. 914,248; March 2, 1909.)

BRIQUETTING—Process of Producing Bituminous Binders and Compositions. Walter S. Wilkinson, Wytheville, Va. (U. S. No. 915,260; March 16, 1909.)

COKE - OVEN — Horizontal Coke-Oven. Francis J. Collin, Dortmund, Germany. (U. S. No. 915,660; March 16, 1909.)

COKE-OVEN. William B. Smith, Sr., Pittsburg, Penn. (U. S. No. 915,630; March 16, 1909.)

COKE - OVENS — Improvements in Portable Coke-Ovens, and Gas Producers, with Portable Base Pieces or Hearths, Applicable for Use as Furnaces or Kilns. Thomas Smith, Newcastle-on-Tyne, Eng. (Brit. No. 839 of 1908.)

SAFETY LAMPS or the Like, Especially Suitable for Use in the Underground Workings of Mines and in Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 1979 of 1908.)

SAFETY LAMPS—Improvements in and Relating to Apparatus for Igniting Miners' Safety Lamps in Underground and Like Places. Ernest A. Hallwood, Morley, Eng. (Brit. No. 25,597 of 1908.)

SAFETY LAMPS—Improvements in, and Relating to Miners' Safety Lamps. Thomas Phillips, Rhondda, Glamorganshire, Wales. (Brit. No. 22,001 of 1908.)

SAFETY LAMPS—Improvements in Apparatus for Electrically Igniting Miners' Safety Lamps or the Like. Ernest A. Hallwood, Morley, Eng. (Brit. No. 28,255 of 1907.)

GOLD AND SILVER

ASSAYING—Process of Assaying. Joseph C. Hames, Goldfield, Nev. (U. S. No. 913,129; Feb. 23, 1909.)

CONCENTRATION — Gold - Concentrating Apparatus. John H. Montgomery, South Omaha, Neb., assignor of three-eighths to Adam Kundert, Omaha, Neb., and five-sixteenths to Martha Montgomery, South Omaha, Neb. (U. S. No. 913,905; March 2, 1909.)

CYANIDE PROCESS—Improvements in the Cyanide Process for Extracting Precious Metals from Their Ores and in Apparatus for Carrying Out Such Process. Communicated from the Just Mining and Extraction Company, Syracuse, N. Y. (Brit. No. 1582 of 1908.)

IRON AND STEEL

ALLOYED STEELS—Improvements in Art of Producing Alloyed Steels. James Churchward, Mount Vernon, N. Y. (Brit. No. 12,383 of 1908.)

BLAST-FURNACE. Samuel H. Hine and William R. Phibbs, Girard, Ohio. (U. S. No. 915,601; March 16, 1909.)

ELECTRIC SMELTING—Method of Operating Electric Furnaces. Paul L. T. Héroult, La Praz, France, assignor to Société Electro-Metallurgique Francaise, Froges, Isère, France. (U. S. No. 914,346; March 2, 1909.)

ELECTRIC FURNACE. Paul L. T. Héroult, La Praz, France, assignor to Société Electro-Metallurgique Francaise, Froges, Isère, France. (U. S. No. 913,888; March 2, 1909.)

EXTRACTING IRON—Method of Extracting Iron from a Pulverized Charge. Carl G. P. de Laval, Stockholm, Sweden. (U. S. No. 913,405; Feb. 13, 1909.)

ORE-SMELTING FURNACE. John T. Jones, Iron Mountain, Mich., assignor, by direct and mesne assignments, to Jones Step-Process Company, a Corporation of Minnesota. (U. S. No. 12,928; March 16, 1909.)

REFINING—Improvements in, and Relating to the Refining of Steel in Electric Furnaces. Compagnie Bismarckhütte, Bismarckhütte, Germany. (Brit. No. 6029 of 1908.)

TITANIFEROUS IRON ORES—Improvements in or Relating to the Treatment of Titaniferous Iron Ores. Alf Sinding-Larsen, Christiania, Norway. (Brit. No. 27,282 of 1907.)

TIN

DETINNING—Process of Detinning. Harry M. Fernberger, Dollar Bay, Mich., and William M. Murray, Philadelphia, Penn. (U. S. No. 913,275; Feb. 23, 1909.)

DETINNING—Method of Detinning Tin-Scrap. Meredith Leitch, Springfield, Mass., assignor to Metal Process Company, New York, N. Y., a Corporation of New York. (U. S. No. 907,061; December 15, 1908.)

ZINC

CHARGING RETORTS—Improvements in Means for Charging the Retorts of Zinc and Other Analogous Furnaces. Emil Dor-Delattre, Dorplein, Holland. (Brit. No. 13,822 of 1908.)

EXTRACTION PROCESS—An Improved Continuous Process and Apparatus for the Extraction of Zinc from its Sulphide. Thomas J. Heskett, Surrey Hills, Victoria, Aust. (Brit. No. 1761 of 1908.)

MINING—GENERAL

DRILLING—Water Attachment for Drill-Steels. James H. Sinclair and Guy D. Neill, Denver, Colo. (U. S. No. 915,230; March 16, 1909.)

MINE PROPS—Improvements in Mine Props. Frederick Nellen, Essen-on-the-Ruhr, Germany. (Brit. No. 21,446 of 1908.)

REMOVING DUST AND GASES—Method of Removing Loose Materials, Dust and Gases from Mines. Frank T. Byers, Mount Pleasant, Penn. (U. S. No. 12,923; reissue Feb. 23, 1909.)

ORE DRESSING

ATMOSPHERIC STAMP. Charles H. Krause, Keweenaw Bay, Mich. (U. S. No. 916,362; March 16, 1909.)

GRINDING MILLS — Improvements in Drum Mills for Grinding or Crushing. Gerhard Zarniko, Hildesheim, Germany. (Brit. No. 16,724 of 1908.)

ORE-SEPARATOR. Alexander S. Campbell, Ortonville, Minn. (U. S. No. 913,258; March 2, 1909.)

PULVERIZING—An Improved Method of and Apparatus for Pulverizng Materials. Joseph de Miniszewski, Kwasow, Poland, and Frank A. Vernon and John C. Vernon, London. (Brit. No. 19,927 of 1908.)

SEPARATING METALS IN SOLUTION—Process of Separating Metals in Solution. Herbert H. Dow, Midland, Mich., and Walter S. Gates, Worthington, Ontario, Canada, assignors to the Ontario Nickel Company, Ltd., Worthington, Canada, a Corporation. (U. S. Nos. 913,708 and 913,709; March 2, 1909.)

METALLURGY—GENERAL

ELECTROLYTIC PRECIPITATION—Method of Precipitating Metals Electrolytically. Arthur Ramén, Helsingborg, Sweden, assignor to Helsingborgs Kopparverks Aktiebolag, Helsingborg, Sweden. (U. S. No. 913,430; Feb. 23, 1909.)

EXTRACTION—Process of Extracting Gold, Platinum, Silver, Nickel, Copper, etc., from Ores. Adolphe Seigle, Lyon, France. (U. S. No. 915,705; March 16, 1909.)

SMELTING—Method of Smelting Ores. James T. Carrick, Johannesburg, Transvaal, assignor of one-half to Basil Stuart Pattison, Johannesburg, Transvaal. (U. S. No. 913,655; Feb. 23, 1909.)

SMELTING-FURNACE—Oil-Heated Smelting-Furnace. August Koch, Hanover-List, Germany. (U. S. No. 915,192; March 16, 1909.)

MINING MACHINERY AND APPARATUS

CARTRIDGE for Mining Purposes. Edward Purcell and Samuel Purcell, Pontefract, England. (U. S. No. 910,722; Jan. 26, 1909.)

DEEP-BORING APPARATUS. Wilhelm Schott, Erkelenz, Germany, assignor to the firm of Internationale Bohrgesellschaft, A. G., Erkelenz, Germany. (U. S. No. 909,234; Jan. 12, 1909.)

ROCK-DRILLING ENGINE—Gasolene-Operating Rock-Drilling Engine. Rolland S. Trott, Denver, Colo. (U. S. No. 915,320; March 16, 1909.)

ROCK-DRILLING MACHINES—Improvements in Rock-Drilling Machines. Communicated from the Ingersoll-Rand Company, New York City. (Brit. No. 13,872 of 1908.)

ROCK-DRILLING MACHINES—An Improvement in Rock-Drilling Machines. Frederick A. Parnell and Albert L. Underwood, Cheapside, London. (Brit. No. 14,529 of 1908.)

ROCK-DRILLS—Improvements in or Relating to Air-Operated Rock-Drills. Joseph Knight, Holyhead, Anglesey and Richard S. S. Bellamy, Liverpool. (Brit. No. 3827 of 1908.)

ROCK-DRILL. John A. Traylor, Denver, Colo. (U. S. No. 913,928; March 2, 1909.)

TUNNEL-BORING DEVICE. Reginald H. Keays, New York, N. Y. (U. S. No. 912,575; Feb. 16, 1909.)

METALLURGICAL MACHINERY AND APPARATUS

CHARGING BLAST FURNACES—Apparatus for Charging and Distributing the Stock in Blast-Furnaces, etc. William C. Mitchell, Chesterfield, England. (U. S. No. 908,594; Jan. 5, 1909.)

ELECTRIC FURNACES — Improvements in or Relating to Electric Furnaces. Albert Le Roy Marsh, Lake Bluff, Ill. (Brit. No. 19,265 of 1908.)

ELECTRIC FURNACES — Improvements Relating to Electric Furnaces. Hugo Helberger, Munchen, Germany. (Brit. No. 13,257 of 1908.)

ELECTRIC FURNACES—Improvements in Electric Furnaces. Jean Bonneau, Paris. (Brit. No. 8904 of 1908.)

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

R. Gilman Brown, who is now in London, expects to go to Manchuria soon.

W. E. Simpson is now manager of the San Francisco del Oro mine, Chihuahua, Mexico.

F. C. Greene, Cleveland, Ohio, is designing equipment for a coal plant in Alberta, Canada.

Henry Krumb is directing developments at the Inspiration mine, near Globe, Arizona.

Edward L. Dufourcq has returned to New York from a trip to Mexico and California.

A. F. Kuehn has returned to the United States from Chile where he had been for four months.

Ralph Nichols, who is now operating at Gilmore, Idaho, was a visitor in New York last week.

Edwin A. Austin has returned from Colombia to San Francisco and will soon start for the Yukon.

Hermann A. Keller, who has been spending the winter in Europe, expects to return to New York early in April.

Edwin E. Chase recently returned to Denver, Colo., from Juneau, Alaska, and has now gone to Oaxaca, Mexico.

W. J. Olcott, now vice-president, will succeed Thomas F. Cole as president of the Oliver Iron Mining Company.

W. S. Keith, of Seattle, is making an examination of a deposit of chrome ore on Fidalgo island, Skagit county, Washington.

Prof. Dr. George Lunge, of Zürich, Switzerland, has been elected an honorary member of the Chemical Society of London.

H. Foster Bain, recently State geologist of Illinois, has become associate editor of the *Mining and Scientific Press*, of San Francisco.

Henry F. Lefevre recently returned to New Orleans from Panama, and sailed for Nicaragua on March 17, to be gone about three months.

A. H. Wethey, who has been spending the winter in Europe, returned to New York last week, and after spending a few days here proceeded to Butte.

James Epperson has been appointed State mine inspector of Indiana for another term, by State Geologist Blatchley, with whom the appointment rests.

Percy E. Barbour has returned from Mexico. After a much needed rest and some professional work in Nevada and California, he will go to Mexico again.

John T. Judd, treasurer of the Tehuantepec Silver Mines Company, has returned to Boston from an inspection of the company's mines at Taviche, Oaxaca, Mexico.

George Crerar has resigned as general superintendent of the Takilma Smelting Company, on account of the death of Charles L. Tutt and the closing down of the company's works.

Frederick H. Morley, Denver, Colo., announces that on account of a largely increased practice in Mexico he has now associated with him the firm of Dominian & Smith, mining engineers, of Mexico city.

Robert Thurston Kent has resigned as engineering editor of the *Iron Trade Review*, Cleveland, Ohio, to become managing editor of *Industrial Engineering*, Pittsburg, a new paper devoted to mechanical-engineering subjects.

T. Ohashi, mining engineer and instructor in the Kumamoto technical high school in Japan, has been in New York. He intends to visit a number of mines in the United States for the purpose of studying mining methods and conditions.

George E. Collins is about to retire from the active management of the Argo Mining, Drainage, Transportation and Tunnel Company at Idaho Springs, Colo., and will be succeeded by Roscoe B. Morton. Mr. Collins will remain associated with the company as consulting engineer.

Thomas F. Cole, who has been president of the Oliver Iron Mining Company—the company managing the mining interests of the Steel Corporation in the Lake Superior region—since its organization, has resigned his position in order to devote his time to his other mining and smelting interests.

Cyrus Robinson, consulting engineer, New York, returned home March 17, having extended his visit to Europe into a trip around the world. While in Japan he paid a visit to the copper works at Osaka. He says that while he was prepared to find that the Japanese had uptodate plants, he was surprised to note their completeness in every detail, comparing favorably with any plants that we have in this country.

Obituary

Henry Biermann died at Monterey, Mexico, March 1, aged 64 years. He was born in Germany, but had been for over 20 years engaged in mining in the northern part of Mexico, and was well known throughout that section. He was president and general manager of the Tamaulipeca Mining Company at Ciudad Victoria.

John Henry Van Dyke, a leader in the early development of Wisconsin mining, pioneer lawyer, and one of the best known public men of the city, died at his home in Milwaukee March 9 at the age of 86 years. Mr. Van Dyke was successively director and vice-president of the Menominee Mining Company, the pioneer of the Menominee range in Wisconsin and the upper peninsula. In 1887 he was elected president of the Chapin Mining Company, and in the same year, the Pewabic Company was organized with Mr. Van Dyke as vice-president.

William Connell died at Scranton, Penn., March 21, aged 81 years. He was born in Cape Breton, Nova Scotia, and when quite young moved with his parents to Hazleton, Penn. When still a boy he began work in a coal mine, and gradually rose to be mine foreman and superintendent of a local colliery. In 1856 he was placed in charge of the mines of the Susquehanna & Wyoming Valley Railroad and Coal Company, with offices at Scranton. In 1870, when the charter of that corporation lapsed he was enabled to purchase the plant and reorganized under the firm name of William Connell & Co. From this beginning he developed into the largest individual coal operator in the Wyoming region, and later organized and practically owned the Connell Coal Company, which he soon developed into a great coal operating company and later sold out to the Lehigh Valley Coal Company. He accumulated a considerable fortune and was interested in many local enterprises. He was accepted as an authority on coal-trade matters and was often consulted by both miners and operators. He acted as sole arbitrator for the Lehigh Valley Company in settling the claims arising from the Mud Run disaster of Oct. 10, 1888, when 63 persons were killed and 120 injured. Only one case went to court. Mr. Connell was also active as a mediator in the attempted settlement of coal strikes and other local industrial disputes.

Societies and Technical Schools

Mining and Metallurgical Institute of Mexico—A meeting to organize this society has been called, to be held in the city of Mexico in July next. The movement to form the society originated with the Cyanide Club of Durango, and is supported by a number of prominent mining engineers in Mexico. Bernard McDonald is in active charge of the proposed arrangements.

Geological Society of London—At the anniversary meeting Feb. 19, the officers were appointed as follows: President, Prof. W. J. Sollas; vice-presidents, G. W. Lamplugh, H. W. Monckton, Dr. J. J. H. Teall and Prof. W. W. Watts; secretaries, Prof. E. J. Garwood and Dr. A. Smith Woodward; foreign secretary, Sir Archibald Geikie; treasurer, Dr. Aubrey Strahan. The following awards of medals and funds were made: Wollaston medal, H. B. Woodward; Murchison medal, Prof. G. A. J. Cole; Lyell medal, Prof. P. F. Kendall; Bigsby medal, Dr. J. S. Fleet; Prestwich medal, Lady Evans; Wollaston fund, A. J. C. Molyneux; Murchison fund, J. V. Elsden.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Goldfield and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 19—At a meeting of the creditors of the Northern California Gold Mines Company before the referee in bankruptcy in Marysville last week, it was developed that the concern had debts amounting to $132,563 and did not even own the Herman mine which it was operating. This mine is at Westville, Placer county, and is still owned by the Herman Mining Company. A. F. Sawhill, of Pittsburg, Penn., president of the bankrupt company said that the stockholders in Pittsburg had no idea that the company had such debts as appeared from the testimony. They had contributed money as called for to meet expenses and the debt in this State had been contracted by those in charge of the mine. In fact the stockholders in Pittsburg were preparing to put up money to pay all the debts when the proceedings were interrupted by the creditors forcing the company into bankruptcy. Expensive machinery had been purchased and the mine was well equipped. It seems that an agent of the company, when offering stock for sale, represented that the company owned the Herman mine and it is hinted that fraud charges may be made before the proceedings are concluded. No trustee in bankruptcy has yet been named as they are waiting for the books to be brought from Pittsburg.

About 300,000 acres have been added to the Tahoe National Forest, contrary to the wishes of numerous mining companies interested in lands now covered by the reserve. It is not yet known in California exactly where the new boundaries are. As originally drawn the new additions to the Tahoe reservation took in old mining ground in Nevada county down to within a few miles of Nevada City. The miners vigorously protested through their Congressional representative, but it is not known definitely whether or not their protests availed.

The new mining camp in Inyo county on the west side of the Argus range, north and east of Mohave and south of Darwin, now has some 300 residents, and numbers of parties are passing through Mohave on their way in. Ballarat is being deserted for the new goldfield. A number of claims have been located and some specimen ore is being shown. A townsite has been platted and a stage line started. The place is called Custer and the stages are running there from siding No. 18. Very little development work has been done thus far, but the ore found on the surface is very promising.

A matter of great moment and great disappointment to the mineowners and managers, of California, is the final passage of the bill regulating the hours of labor in mines, mills, smelting works, etc. The new law provides that the period for employment for all persons in underground mines in search of minerals, whether base or precious, or who are engaged in such underground mines for other purposes, or who are engaged in underground workings for the purpose of tunneling, making excavations, etc., or who are employed in smelters and other institutions for the reduction or refining of ores or metals, shall not exceed eight hours within 24 hours, and the hours of employment in such work shall be consecutive, excluding, however, any intermission of time for meals; provided that in case of emergency where life or property is in imminent danger the period may be for a longer time during the continuance of the emergency.

The law also provides that any person who shall violate any provision of the act, who, as foreman, manager, director, or officer of a corporation, or as the employer or superior officer of any person, small command, persuade or allow any person to violate any provision of the act, shall be guilty of a misdemeanor, and on conviction shall be punished by a fine of not less than $50 nor more than $300, or by imprisonment of not more than three months. And the court is given discretion to impose both fine and imprisonment.

In cases where there are strong miner's unions, as in Nevada and Shasta counties, an eight-hour rule prevails already, but in most parts of the State 10 hours' labor is the rule. This new law changes all that as may be noted from the provisions quoted. In smelting works, quartz mills, etc., the change will be particularly noticeable, as it will materially increase present costs of ore reduction. In the Mother Lode section of the State, especially where the mines are being worked on very narrow margins, owing to the low grade of the ore, the effect of this new law will doubtless be the closing down of certain properties. Where high-grade ore is the rule, as in Nevada county, the mines can stand the advance in costs of mining and milling, but in other parts of the State hardship will be worked on mineowners undoubtedly. There have already been increased costs for lumber, supplies, etc. With smaller mines throughout the State the impending changes will be quite radical and probably a number will cease work altogether.

Another bill which has become a law of the State is more favorable to mineowners. It provides that every person who carries on the business of a pawnbroker or who purchases gold bars, gold quartz, or gold bullion, or mineral containing gold, and who fails to keep a record in a register of the date, duration, amount, etc., of every loan made by him, or an accurate description of the property pledged, or estimated value of the property purchased or the name of residence of the pledgor or seller, or to keep an account of all sales made by him, is guilty of a misdemeanor.

The law also provides that every pawnbroker or person who purchases gold bullion, gold bars, gold quartz, or mineral containing gold, who fails or refuses to produce for inspection, his register or account of sales to any officer holding a warrant, authorizing him to search for personal property, or the order of a committing magistrate directing an officer to inspect such register or account of sale is guilty of a misdemeanor. This law was framed in the interest of mineowners to protect them from "high grading." It is thought they will be better able now to trace specimens, bullion, amalgam, etc., than has been the case. In some mining towns where rich ore is being mined, there have sprung up places where it is easy to dispose of stolen ore, specimen rock, bullion, etc. This law will make it much more difficult for dishonest men to dispose of such stolen property, and make it easier to trace them if they do.

Salt Lake City

March 20—During the week ending March 13 Tintic mines shipped in 20-ton cars: Swansea, 6; Brooklyn, 12; Beck Tunnel, 5; Black Jack, 4; Dragon Iron, 35; Iron Blossom, 15; Colorado, 23. The following mines shipped in 50-ton cars: Centennial Eureka, 45; Eureka Hill, 5; Sioux Consolidated, 14; Ajax, 3; Yankee, 2; Bullion Beck (leasers), 3; Eagle and Blue Bell, 3; May Day, 2; total, 177 cars.

The Park City ore shipments for the week ending March 13 were: Silver King, 993 tons; Daly-West, 362 tons; Daly-Judge, 334 tons; total, 1,689 tons.

Western mining operators are organizing for a strong fight to prevent the proposed reduction in the tariff on the lead contents of ores, from 1½ cents to 1 cent

per pound, as recommended by the Ways and Means committee. A meeting of Colorado, Utah and Idaho operators has been held at Salt Lake City for the purpose of appointing a committee and raising a fund to establish headquarters at Washington where the committee will sit during this session of Congress and plead the cause of the lead industry. [The above meeting was evidently called under a misapprehension. No change in the tariff on the lead content of ores was provided in the proposed bill.]

Butte

March 19—With the recent decline in the price of the copper, there has been no apparent curtailment in the Butte copper production. The Amalgamated mines, with perhaps the exception of the Anaconda, are all sending their regular tonnage to the smelters. Operations at the Anaconda have been somewhat retarded of late by gas, due to fires in the old stopes, on the upper levels.

The number of miners employed today is about two-thirds the number employed two years ago, while the number of tons produced is nearly as large. The shafts have all been sunk to greater depths. The High Ore shaft, through which the water from the Anaconda, Parrot, and North Butte companies, is pumped, has reached a depth of 2800 ft. The Diamond shaft is now also being sunk to that level, and connection will be made with the High Ore shaft.

Denver

March 19—The Livingstone mine, formerly known as the "Potato Patch," at the base of Sugar Loaf hill, in Boulder county, has been reopened after having been idle for three years, and has recovered the rich shoot which made the mine famous when it was discovered about 10 years ago. In addition to a good body of smelting ore, there is a 5-in. streak of sylvanite. The ore is found in the Nyanza, a cross-vein to the main Livingstone dike, near the point of intersection, and in a contact between granite and schist. The first discovery was made in tilling the ground for a potato crop, and from the decomposed outcrop of the vein $35,000 was recovered with a plough and scraper. The extension of the Nyanza vein is the Ragged Top, and in the lower workings of this group, ore has been struck which is believed to be a continuation of the Nyanza shoot, which, if it maintains its pitch, must enter the Ragged Top ground with depth.

The old Gilpin county camps of Central City and Black Hawk are looking better than for some time past. Several companies are starting up again on company account, and the leasers are doing well. The Newhouse drainage and transportation tunnel will drain and open much new ground under the old mines. The Fifty Mines Company, now owning the Bobtail, Gregory-Fisk and other great producers of the early day is sending out big reports, and the outlook is promising for a good year.

Goldfield, Nevada

March 16—It is reported that as a result of recent examinations of the mines and prospects of Eldorado cañon, Lincoln county, a custom mill of 30-ton capacity will be erected this spring.

John H. Doyle, special examiner of the U. S. Land Department will take evidence at Reno in land cases in the Olinghouse and other mining districts where it is claimed the Southern Pacific Railroad Company obtained patents to mineral lands by fraudulent methods.

Reports are being circulated of a new district recently discovered north of Lodi and near the Churchill-Nye county line. The district is about one mile wide and six miles long. The formation is porphyry surrounded by granite. As yet the deepest shaft is 100 ft. The ore contains gold.

It is now generally believed that General Manager Mackenzie, of the Goldfield Consolidated, will give up the management of the property, in accordance with an agreement made, when he first assumed charge, that he be allowed to drop the more active duties of management upon the completion of the mill, the opening up of the various orebodies and systematizing the operating department. Mr. Mackenzie will retain the general direction of the property, but will devote the greater portion of his time to the Coalinga oilfields of California, in which he is interested.

The output of the Goldfield district for the week ending March 13 was 6000 tons with an estimated value of $220,000. Production of the Tonopah mines for week ending March 13 was: Tonopah Mining, 3100 tons; Montana, 780 tons; Belmont, 850 tons; MacNamara, 250 tons; Jim Butler, 200 tons; West End, 135 tons, and Midway, 100 tons; estimated total value, $140,000.

Despatches from Reno state that orders have been given to have the railroad from Goldfield to Ely surveyed at once. The road may follow the west side of Hot Creek valley, touch Tybo, Helena, Bellehelen and pass close to Revielle, opening up a large territory to the north and east of Tonopah and Goldfield. It is hoped that the road will be completed early in 1910. The project is financed by "Borax" Smith and associates.

A hearing has been set for March 29 by the Interstate Commerce Commission on the question of making Reno a terminal point for freight and passenger service. At present all freight shipments from the East billed to Nevada points in the southern part of the State pay freight to Sacremento and back to Reno again, although the goods are carried no farther than Reno. Should Reno be made a terminal point it will mean the saving of thousands of dollars a year to mining camps in the State.

Paris

March 8—The Société des Mines d'Or d'Adieu-Vat et de Bonne-Aventure (French Guiana) has lately published results of the fiscal year ended June 30, 1908. This company is one of the few which work gold lodes in French Guiana. The ore was mainly extracted from the Rocher and Madame lodes and crushed in a 10-stamp mill. Owing to the difficulty of finding labor and also to the bad climatic conditions which prevailed in 1907-8, it was not able to put up the cyanide plant, nor to get sufficient ore to supply 20 stamps. The monthly mill output was 85 metric tons from the Rocher lode averaging 38.2 grams of gold, and 417 metric tons from the Madame lode averaging 15.72 grams of gold. Since July last conditions have improved both as regards the output and the richness of the ore. From July to October the monthly mill output was 160 metric tons from the Rocher lode averaging 60.6 grams of gold, as against 38.2; and 658 metric tons from the Madame lode averaging 16.15 grams. The monthly gold production in this last period was 20,912 grams of gold, worth over $12,000. Under these conditions the company has been able to meet all expenses with the gold produced. It must be noted it is the first time such a thing has occurred in French Guiana in a deep-mining enterprise.

The Compagnie Coloniale de Dragages Aurifères and the Société Anonyme du Sparwin (Maroni) report that the 5-cu.ft. gold dredges they sent to French Guiana have safely arrived, and that they are now under erection.

A lead and zinc mine is now being developed in France by a company organized in 1908 under the name of Société Minière et Métallurgique de Villemagne, with a capital of 1,500,000 fr., or $300,000. A concession had been granted a long time ago for an area of 13,000 hectares; but the first owners worked various lodes at the same time and did not obtain satisfactory financial results. The new company will concentrate all its efforts on one lode, where over 40,000 tons of galena ore is now blocked out. A concentrating plant is to be erected with a capacity of 50,000 tons of ore per year. The board includes several leading mining engineers.

The Société Minière et Métallurgique de Penarroya has lately placed a contract for a water-jacket lead furnace. It is the first attempt of this important company to use water-jacket furnaces in place of the old Pertusola type. This water-jacket will measure 44x156 in. at the tuyere level. It will be fitted with 20 tuyeres and be 24 ft. 6 in. high from the ground to the charging platform. Charges will be elevated to the mouth of the furnace by means of skips. Blast will be supplied by a Rateau turbo-blower. The company expects to smelt about 200 metric tons of ore per day in this new furnace.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Calumet & Arizona—The production in February was 2,393,000 lb., compared to 2,380,000 lb. in January.

Superior & Pittsburg—Production in February was 1,900,000 lb., compared to 2,000,000 lb. in January.

GILA COUNTY

Gibson—This mine at Globe is reported to have been sold to a Boston syndicate.

California

BUTTE COUNTY

Mammoth Channel Gold Mining Company—This company near Magalia has installed a new hoist and is enlarging its shaft to two compartments.

Oro Light and Water Company—The temporary dam built to fill in the break in the Miocene ditch dam, has proved too weak to hold the water and went out the day of completion. A second barrier is to be built. The dam is the intake of the power plants for mines below Magalia.

San Francisco—This mine, near Wyandotte, will shortly be provided with a 10-stamp mill.

EL DORADO COUNTY

Bean Hill—A quantity of mining machinery is being hauled to this mine near Grizzly Flats. Mr. Caldwell is superintendent.

Big Cañon—The unwatering of the mine is nearly completed.

Prevolcanic—The 700-ft. tunnel is being driven to the gravel channel but work has been interfered with by the rains and seepage water. The development of other gravel claims in the vicinity will depend upon the results obtained in this mine.

KERN COUNTY

Ferris—J. B. Ferris has lately discovered, near Caliente cañon, a deposit containing both tungsten and yellow ocher. Arrangements are being made to work the deposits.

Golden Group—J. B. Ferris, owner, has found tungsten ore of high grade in what he supposed to be worthless material.

MARIPOSA COUNTY

Mount Gaines Consolidated—The 20-stamp mill is in operation. A. R. Maines, of Los Angeles, has become general manager, and W. R. Wardner, of the same place superintendent.

1909 Mining Company—This company, operating the Enterprise mine, near Hornitos is installing a new air compressor. Good ore is being taken from the mine. Fred H. McCall is superintendent.

MONO COUNTY

Masonic District—The snow is impeding operations in this section but some men are working in the Pittsburg-Liberty and work will soon commence on the Tipton.

Standard Consolidated—The working force at this mine, Bodie, is being increased by superintendent W. H. Landers. Mr. Albert Fries has been elected president of the company.

MONTEREY COUNTY

Shamrock—This company is at work developing molybdenite claims in Stonewall cañon, between Soledad and the Pinnacles. It has also located other claims in Bryan cañon.

NEVADA COUNTY

Central Consolidated—At this mine, eight miles from Grass Valley, operations have been resumed and the 20-stamp mill started. The plant has received an entire overhauling.

Lecompton—The work of unwatering this mine at Nevada City has been commenced under Superintendent Colt. The mine is owned by A. M. Gilbert, of Santa Barbara. It will take four weeks to drain the mine.

Oustomah—E. H. Wilson, of Nevada City, who is operating several mines in Sierra county, has secured a bond on this property. The mine is already well equipped but some few changes will be made and deep sinking carried on while drifting is being done. Frank M. Evans will be manager of the property.

Ben Franklin—White Brothers, owners, near Grass Valley, continue to take out good ore.

Champion—Tributers are working in virgin ground in some of this company's mines at Nevada City and are taking out good paying ore.

Union Hill—In the Greek ledge, near Grass Valley "jewelry" rock is being mined at present. The ore is being blasted out on the lower levels.

PLACER COUNTY

Rawhide—This quartz property, six miles from Towle, has been sold through F. L. Bryson to Eastern men. New stamps will be added to the mill and other improvements made. A wagon road will be built, and packing over trails given up.

PLUMAS COUNTY

Nevada Consolidated—J. D. Murray and H. H. Hunter, of Reno, Nev., have arranged for shipment of a 30-stamp mill to this mine in Butte Valley, where they have a large body of low-grade ore.

Shoofly Copper Mine—A long development tunnel is being run on this copper property at Indian Falls under superintendence of G. H. Goodhue. The lode is wide. This property is owned by Seattle and Tacoma people.

SHASTA COUNTY

Western Exploitation Company—A new hoist is being installed at the Milkmaid mine, French Gulch and the shaft will be sunk deeper.

SISKIYOU COUNTY

It is expected that the dredge at Garvey Bar will be remodeled and set at work again. This is 12 miles below Hornbrook. At the Northern California Mining Company's property, Croy's Bar, a dredge will soon be used, the ground having prospected favorably. At Hamburg Bar, on the Klamath, a dredge is being built and will start up in about two months.

Enterprise—In the Lone Jack tunnel a lode of high-grade ore has been struck.

Lewis & Boyer—At this group five miles from Fort Jones, owned by citizens of Colusa, a stamp mill is to be erected.

TRINITY COUNTY

Golden Jubilee—This property at Carrville, owned by Napa county men, was recently closed by attachment. Enough money has now been raised to lift all the attachments and work will be resumed when the snow is all gone.

TUOLUMNE COUNTY

United Gold Mining and Milling Company—A payment has been made on the Tarantula mine near Jacksonville. T. J. Russell is manager. More machinery is to be installed.

United Mines Corporation—The properties in the East belt are still idle, no adjustment having been made between the company and the miners as to their differences.

Colorado

LAKE COUNTY—LEADVILLE

Anona—This company is sinking a shaft on the Gypsy Carbonate claim; another 18 ft. should reach the top of the limestone.

Yak—Resurrection No. 1 has been unwatered and the breast of the tunnel is now in the Fortune territory. It is understood that the management of the tunnel intends to lease the property.

New Monarch—As soon as the sinking of the Cleveland shaft is completed it is the intention of the company to sink the New Monarch shaft several hundred feet deeper.

Granite Tunnel—This bore is now in 467 ft., and a few days ago two veins of ore were encountered. In addition to this there is a body of ore 11 ft. wide on which they have been working for a week. When snow disappears it is the intention of the company to put in machinery.

Fanny Rawlings—For the last week work on this Breece Hill property has been been carried on at the lower levels in a body of ore that was recently opened.

Penn—This property is shipping daily 200 tons of an excellent grade of iron ore; 100 tons being sent to the Arkansas valley plant and the other 100 goes to the Salida smelter. The mine is worked by leasers.

OURAY COUNTY

Camp Bird—Under date of March 9, 1909, the directors submit the following report on the working operations of the company for the quarter ending Jan. 31, 1909: Dry ore crushed, 20,301 tons; receipts from bullion sold (including cyanide products), $435,303; concentrates sold, $72,229. Working expenses (including development, transportation, and treatment of product), $152,467; surplus, $355,065. On Jan. 7, dividend No. 28, of 1s. per share (£41,000) was declared, payable Feb. 6, 1909.

Mine: Number of feet driven, 1105; number of feet in raises and winzes, 223; cubic feet stoped, 124,000.

Production: Of the ore treated during the quarter, about 70 per cent. was withdrawn from the reserves in stopes. The total dry ore broken and in the stopes on Jan. 31, 1909, amounted to 70,653 tons. Everything at the mine and mills has progressed satisfactorily, and a high state of efficiency has been maintained throughout.

TELLER COUNTY

Gold King—Except during labor troubles, this mine is idle the first time in 17 years. It is understood that it will soon be started up under lease. This was the first discovery of ore in the district. It is controlled by Messrs. Lenox and Giddings, of Colorado Springs.

El Paso—The annual meeting of the stockholders was held in Colorado Springs and the old directors reëlected. President Burris' report shows that during last year about $423,000 dollars worth of ore was shipped by lessees. Announcement has been made that the leases will not be extended beyond May 1. J. W. Nichols, of Cripple Creek has been appointed superintendent of the property.

Prince Albert—The Union Leasing Company, of Cripple Creek, has leased this mine and a contract has been let to Walter Erickson for driving the tunnel 500 feet. The property is situated on the south side of Beacon hill not far from the El Paso. The lessees are also working several other leases. C. G. Jackson, of Cripple Creek, is in charge of the leasing company.

Trilby—It is understood that the mill on this property is to be remodeled. The mill was built a number of months ago and was designed to treat low-grade ores. The property is situated on Bull hill and is controlled by Pittsburg capitalists. A number of leasers are at work on the property, as well as the company. James T. Stewart, of Cripple Creek, is in charge.

Idaho

KOOTENAY COUNTY

Mineral Point—This mine has been added to the list of Cœur d'Alenes shippers. A car of ore sent to the Federal Mining and Smelting Company's sampling works and from there to the smelter netted $1340.

Idaho Smelting and Refining Company—John Mocine, secretary, has been appointed receiver.

OWYHEE COUNTY

King-Philip—A good lode of silver ore is reported in this mine in Diamond basin.

SHOSHONE COUNTY

Amador Gold and Copper—A temporary injunction has benn granted restraining the sale of stock in payment of a 2c. assessment last October. It is claimed that funds have been squandered.

Southern Hercules—E. J. Hunter reports that orders have been placed for equipment to develop 12 silver-lead claims in the Cœur d'Alenes. The main shaft is down to the 200-ft. level, from the bottom of which a drift has been run 60 ft., opening a vein of carbonate ore. A 600-ft. tunnel is to be driven to a point directly under the shaft which will give a depth of 300 feet.

Indiana

CLAY COUNTY

The miners of the Brazil Block district have secured the discharge of Silas Risher, mine-boss of the Rosebud mine, operated by the Vandalia Coal Company, for selling rooms to miners. Four men made affidavit to having purchased rooms from Risher at prices ranging from $10 to $20 per room.

PIKE COUNTY

Notices have been posted at No. 4 mine at Ayreshire that the mine will close down indefinitely on March 25. The closing is caused by overproduction. More than 250 men will be thrown out of work.

VERMILION COUNTY

Clinton Coal Company—This company, operating Crown Hill mines Nos. 1, 2 and 3, west of Clinton, claims to have made a record for steady operation. Mine No. 1 has missed only one day since Feb. 1, and the other two have missed only two days each. The three mines employ 800 men, and the pay-roll averages $25,000 every two weeks, and have averaged five days each per week since last November. Since the Deering company recently went into the hands of a receiver the Clinton company has been receiving orders for about 2000 tons of coal daily, to go to the United States Steel Corporation at Gary, which had been supplied by the Deering company. The Clinton Coal Company bought 80 acres of coal land from J. H. Bogart, of Clinton, for $8000 recently. This with 1600 acres recently optioned by the same company, adjoins its present tract.

WARRICK COUNTY

The coal mines are now running from four to five days a week. Domestic trade has been light, owing to the mild winter, but the operators think that when the steam trade opens in April there will be a better demand for southern Indiana coal.

Michigan

COPPER

Winona—Excavation has been begun on the site of the new stamp mill, on the banks of the Sleeping river. The mill will handle the rock from both this company and the King Phillips property.

Ojibway—Sinking close to the 800-ft. level is in progress at No. 2 shaft and as soon as sufficient depth is obtained a crosscut will be started to cut the formation. The crosscut from the level above is passing through a broken trap, indicative of the close proximity to the lode. Sinking is under way at No. 1 shaft toward the same level.

Victoria—Some very encouraging ground in the upper levels has recently been opened. A satisfactory state of mineralization continues in the drift from the 22d level.

Lake—The north drift from the 2d level has again entered the copper bearing formation. This drift passed out of the lode about 40 ft. from the shaft and after continuing it in the same direction for considerable distance again entered it. At the 3d level a crosscut is being driven

westward to cut the formation. This crosscut is now in about 60 feet.

Isle Royal—The new Southern shaft of this company and shafts Nos. 4, 5 and 6 are revealing a satisfactory state of mineralization and with the new hoisting plants in commission at No. 4 and 6 a decided increase in production will be made. President Agassiz of the Calumet & Hecla is asking shareholders for proxies to be voted at the annual meeting, April 7, for the election of a new board of directors, the majority to be chosen from the present directors of the Calumet & Hecla company.

Island—At a meeting recently held at Duluth the following officers and directors were elected: president, Thos. F. Cole; vice-president, Geo. C. Stone; secretary, Fred W. Nichols. Directors, Thos. F. Cole, Geo. C. Stone, F. W. Nichols, G. A. Tomlinson, Henry Nolte, G. G. Barnum, W. Ames, F. W. Heimick and O. J. Larson.

Oneco—Operations will in all probability be resumed during the coming summer. The gratifying results being obtained at the North Baltic Exploration company's land, hold out great encouragement. There is a shaft down 500 ft., but no work of any consequence has been done on the property for several years. The company has $30,000 in the treasury and 30,000 shares of unissued stock.

Montana

Butte District

Butte Reduction—An experimental concentrator is in course of construction. It is understood that the ore from the Elm Orlu claim owned and operated by W. A. Clark will be treated here as soon as the concentrator is completed.

Butte Superior—The 1400 level is being prospected with the hope of striking the shoot of copper ore recently opened up on the 1000 level of the Elm Orlu, which adjoins the Butte Superior on the west.

Davis-Daly—A crosscut is being driven on the 1400 level of the Colorado to intersect a body of ore which was lately discovered in diamond drilling.

Copper Eagle—Development work is being pushed on the 350 level. A 50-ton shipment of ore was recently made.

Butte Central Copper Company—This is a new organization with a capital of $2,500,000 divided into 250,000 shares par value $10 per share. The company succeeds as the bankrupt Butte Central and Boston Copper Corporation, and owns the Ophir mine in the south portion of the camp. The officers of the new company are: William H. North, president; R. W. Tufts, treasurer and William O. Burns, secretary.

British-Butte—Col. M. H. de Hora leaves for London, March 23, to make report to the stockholders of the company. The dredge which was completed Feb. 1 has been in continuous operation since that date.

Silver Bow County

Raven—It is reported that this company is to be reorganized.

Nevada

Esmeralda County—Goldfield

Consolidated Rep Top Lease—A new vein has been opened on the 300-ft. level, about 100 ft. west of the vein from which the ore is at present being extracted.

Gold Bar Extension—Work has been resumed by lessees. A hoist has been installed and a crosscut will be run at once for the Gold Bar vein, which is thought to pass within 100 ft. of the shaft.

Great Bend—A winze is being sunk in the ore recently opened on the Diadem Lease. The orebody showing in the winze averages 18 in. of shipping grade. The shaft will be sunk an additional 100 ft. and a crosscut driven to the vein at that depth.

St. Ives—A. A. Codd, president, has developed a plan of reorganization, the new company to be known as the Codd Mines Company. A group of six claims in the Walker river mining district, upon which promising surface showings are found, has been acquired, and it is here that the most extensive development work will be carried on. The new company will be capitalized for 3,000,000 shares, par value $1 each; stockholders in the leasing company will receive share for share in the new organization, though an assessment of 1c. per share will be made for the purpose of paying old debts and providing a fund for the erection of a small mill to be constructed on the Walker river property.

Goldfield Consolidated—In February the new mill treated 12,858 tons of ore, yielding an average of $40.75 per ton. The Combination mill treated 2291 tons. The total for both mills was 15,149 tons, yielding $618,315.

Esmeralda County—Mina

Blue Light Copper—A 100-h.p. gasolene hoist has been purchased for this property and is now en route from San Francisco. The shaft, now 720 ft. deep, will be sunk to water-level, which is estimated at 1000 feet.

Esmeralda County—Hawthorne

Hawthorne Lucky Boy—The lease being worked by Hubbard and associates, of Chicago, has produced upward of $200,000, and is said still to have ore blocked out above the 300-ft. level. Shipments amount to about 50 tons per day. The lease expires Aug. 1, but the shaft is now being sunk to the 500-ft. level with the expectation of extracting an extra-heavy tonnage before the expiration of the lease. The district, situated about six miles south of Hawthorne on the old Bodie road, covers an area about six by eight miles in extent, and is well mineralized, with silver and lead together with some copper.

Esmeralda County—Gold Mountain District

Mammoth Mining and Developing Company—This company, with headquarters at Goldfield, recently acquired the old French claims near Old Camp. The property is developed by a shaft 200 ft. deep and several adits. Contracts are to be let for the construction of a mill and a pipe line about three miles in length.

Esmeralda County—Silver Peak

Pittsburg Silver Peak—The following extract from the annual report shows the net earnings of the company for 1908. The stamp mill was completed in April, but was only in partial operation the first three months of the year, hence the itemized details; January to March, 1908, tons milled, 18,096; bullion receipts, $116,233; net earnings, $41,441. April to December, 1908, inclusive, tons milled, 87,574; bullion receipts, $848,713; operating expenses, $499,789, and net earnings, $348,923. The railroad extending from Coaldale to Blair, operated and owned by the company, has been equipped with a gasolene combination car to take the place of the locomotive and is now in successful operation at reduced expense.

Esmeralda County—Rawhide

Marigold Lease—Ore is being extracted from the north drift of the 130-ft. level. The last shipment to the Hazen sampler netted $198.30 per ton. More care is being taken in the sorting of the present shipment.

Mint Lease—The orebody recently encountered on the 300-ft. level shows no signs of decreasing value although drifted on 80 ft. to the north and 70 ft. south. The vein varies from 4 to 6 ft. in width.

Nye County—Round Mountain

Round Mountain Mining Company—Material for the addition to the mill is now being hauled from Tonopah to Round Mountain.

Nye County—Ione

Grand View—J. O. Kinney, president, is now in the east negotiating the purchase of a hoist and a five-stamp mill. The company owns four claims, though development work has been confined chiefly to the Grand View lode.

White Pine County

Nevada Consolidated—In the first half of March this company mined upward of 2000 tons of ore per day. Production in January was 1,451,000 lb.; February, 1,086,000.

Cumberland-Ely—January production, 1,094,218 lb.; February, 1,233,492.

New Mexico

SIERRA COUNTY

County Seat—The legislature passed a bill making Cutler the county seat instead of Hillsboro. The bill also provides that that portion of Socorro county extending south along the eastern boundary of Sierra and west of Lincoln and Otero counties shall be taken into Sierra county.

SOCORRO COUNTY

Kelly Mine—Monthly shipments aggregate 15 to 20 cars zinc carbonate.

Graphic Group—The Sherwin-Williams Company is shipping 10 to 15 cars of ore per month. Jos. Brown, of Kelly, New Mexico, is in charge of the mine.

Mistletoe and Magdalena Tunnel—Machinery is arriving for a 50-ton dry concentrator. The ore will be sized by impact screens and concentrated on pneumatic tables. W. F. Gordon is superintendent.

Mill Cañon Copper—George Keith is manager. The company recently purchased the Wheel of Fortune group, 12 miles south of Kelly.

Old Soldier—Mike Wolf, manager and principal owner, recently shipped two cars of lead-silver-copper ore, which gave good returns.

South Dakota

For some time past there has been under consideration the building of a modern smelter in the Black hills. The first definite step in that direction was the leasing of the Hester A and Rainbow claims in Galena on March 16. The ore is refractory silicious material carrying pyrite, and is suitable for matte smelting. The lease runs for two years, with the provision that the building of the smelter shall begin within four months and that it shall be in operation within eight months from date. Negotiations have been entered upon for the Richmond ground, under lease till the latter part of this year to the Branch Mint Operating Company.

CUSTER COUNTY

An effort is being made to resume the mining of lithographic stone near Custer, where the Black Hills Porcelain, Clay and Marble Company holds several claims as yet unpatented.

LAWRENCE COUNTY

Ruby Mining Company—This company, capitalized at $1,000,000, has recently been formed to work a group of claims in the Tinton district. An 80-h.p. boiler and engine are being installed for development purposes.

Gold Eagle—Superintendent Keller is sinking a shaft to go 200 ft., near Maitland.

Golden Girl—Work has been commenced by A. M. Masters, of Jacksonville, Ill., on a wide ledge of ore.

Johnston—Sinking on Iron creek will soon be commenced by Thomas Johnston, the owner. The 40-ft. shaft will be sunk to a depth of 100 ft. New machinery is now being installed on the property.

Tinton—Superintendent Carnahan has succeeded Superintendent Noakes, of Chicago, and the mill will now undergo still further changes before operations begin this spring.

PENNINGTON COUNTY

Balkan—This company, which has been operating a five-stamp mill in the Rochford district, is adding five more stamps to its equipment.

Utah

JUAB COUNTY

Plutus—Ore of fair grade has been encountered in drifting to the north at a depth of 200 ft.

Zuma—Work will be resumed on the lower levels during the coming month.

Swansea Extension—The shaft is 140 ft. below the tunnel level. Drifting to the north and south is in progress and the shaft will be sunk an additional 100 feet.

Bullock—A crosscut is being driven west from the 210-ft. level.

Tintic Central—The shaft has a depth of 220 ft. and is in limestone. A hoisting plant has been ordered and power will be obtained from the Telluride Power Company. The property adjoins the Iron Blossom.

Mammoth—A shipment of 30 tons of high-grade ore was recently made, being consigned to Irvington, N. J.

East Tintic Consolidated—A depth of 75 ft. has now been reached by shaft.

Tintic Central—The shaft is down 235 ft. and a drift to the east will be started toward the south extension of the Iron Blossom vein.

Victor—Work is in progress on a body of copper ore on the 800-ft. level.

Murray Hill—Col. T. P. Murray, of Los Angeles, has taken an option on the East Humbug, Comstock, Knight, and Jack Fraction north of the Yankee Consolidated. The company will be called the Murray Hill Mining Company.

Tintic Empire—A contract has been let for sinking 100 ft. of double compartment shaft.

Wicklow—A tunnel is now in 427 ft. and a contract will be let for additional work at once.

May Day—The shaft is now down 945 ft., and is to be continued until a depth of 1000 ft. is reached.

Iron Blossom—Jesse Knight states that dividends are to be commenced in April and claims to now have a larger body of high-grade ore than was ever exposed at one time in the Colorado. Twelve cars recently marketed assayed 40 per cent. lead, 113 oz. silver and $13 gold. The property is shipping 100 tons per day to the Tintic smelter.

SALT LAKE COUNTY

Peruvian—Ore has been struck on the main level. While no assays have been made it is of a shipping grade and carries copper, lead and silver.

Cardiff—On the drain tunnel level, 18 in. of shipping ore carrying good values in copper, lead and silver has been found, besides 8 ft. of low-grade rock.

Columbus Consolidated—On the 400-ft. level, west of the shaft, the management has explored an orebody for a length of 150 ft. with a width in places of 15 to 20 ft. The rock runs well in silver and copper. One carload per day is being marketed.

Boston Consolidated—February production, 2930 tons sulphide; 129,000 lb. copper delivered; 35,000 tons wet-milled, 32,000 tons dry; 1575 tons dry concentrates, yielding 711,000 lb. copper.

Washington

FERRY COUNTY—REPUBLIC

New Republic—This mine is reported to be employing 50 men and shipping ore regularly to the Granby and Tacoma smelters. A car of new mine equipment, including a hoist, air compressor, machine drills and drill sharpener was unloaded last week.

San Poil-Republic—This newly organized smelting company proposes to begin constructing a smelter near Republic. The officers are R. J. Howard, Spokane, president; W. B. Parker, Spokane, vice-president; R. J. Leonard, Republic, secretary. The company is being financed by Spokane and Seattle capitalists.

FERRY COUNTY—KELLER

Byrne—Development work has opened up a new silver-bearing vein. Dr. P. S. Byrne and J. R. Cassin, of Spokane, and R. L. Boyle, president of the Keller & Indiana Consolidated Smelting Company, are the principal owners.

Canada

BRITISH COLUMBIA—KAMLOOPS

Iron Mask—This mine, owned in England, has been bonded by United States operators, who have about 20 men employed in its further development. Other

mineral claims in the camp are under option to American capitalists, who are arranging to have them well prospected.

BRITISH COLUMBIA—AINSWORTH DIVISION

Wagner Group—D. C. Corbin, of Spokane, has, it is announced, bonded the Wagner group of mineral claims situated in the northern part of Ainsworth mining division, on the Duncan river slope of the Selkirk range. This has long been known as the most prominent mining property in that part of the country, but owing to its distance from transportation facilities it has not been extensively developed. It was described by W. A. Carlisle (then provincial mineralogist) in his annual report for 1897 as being "the highest mine in the province, elevation 8200 ft." It is in the "great lime dike" of the Selkirks. R. W. Brock, in the summary report of the Geological Survey of Canada for 1904, stated that the ore is cubical galena with some pyrite and gray copper. Two veins of ore have been opened on the property.

BRITISH COLUMBIA—CROW'S NEST PASS

D. C. Corbin, of Spokane, Wash., who last year constructed 14 miles of railway, from McGillivray, on the Canadian Pacific Crow's Nest branch to the Corbin Coal and Coke Company's coal mine, has obtained the necessary authority from the provincial legislature of British Columbia for the extension of his company's railway 40 miles south to the International boundary.

Queen Victoria—This mine, on which an option was held and recently relinquished by New York men, has been bonded by the Consolidated Mining and Smelting Company of Canada, Ltd., which owns other mines in Kootenay and the smelting works at Trail. The mine is situated about eight miles from Nelson and 37 miles from the Trail smelter, with which there is railway connection. There is a large body of low-grade copper ore in the mine.

BRITISH COLUMBIA—EAST KOOTENAY

R. L. Broadbent, of the Geological Survey of Canada, who was in charge of the Canadian mineral exhibits at the World's Fair, St. Louis, in 1894; at Liege, Belgium, in 1905; at Milan, Italy, in 1906, and at Christchurch, New Zealand, in 1907, has obtained, for inclusion in the British Columbia display at the Alaska-Yukon-Pacific Exposition, representative samples of coal from the Crow's Nest Pass coal mines, and specimens of lead and silver-lead ores from the North Star, Sullivan, and St. Eugene mines, all in Fort Steele mining division, East Kootenay. Samples of various grades of lead-silver concentrates have been obtained from the St. Eugene mill as well. Mr. Broadbent is continuing his work in West Kootenay.

BRITISH COLUMBIA—SLOCAN

Emily Edith—Another shoot of high-grade silver-lead ore has been found in this mine, which is being worked in conjunction with the adjoining Standard mine, under the direction of one of the owners of the latter, George H. Aylard, of New Denver, B. C. The Emily Edith has been opened by six adits and about 9000 ft. of underground development done. The Standard last year shipped 1250 tons of first-class ore, containing approximately 106,000 oz. silver and 1,600,000 lb. lead. A similar quantity of milling ore was placed on the dump to await provision of plant for concentrating.

BRITISH COLUMBIA—VICTORIA

Mr. Orr, manager of the exhibition association of Toronto, Ontario, has interviewed the provincial government with the object of inducing it to make suitable display, thoroughly representative of the mining industry of British Columbia, at the Toronto fair, which is regarded as Canada's national annual exhibition.

The Consolidated Mining and Smelting Company of Canada, Ltd., made a shipment of pig lead from its lead refinery at Trail to Australia by the steamer sailing from Victoria on Feb. 26.

The output of coal from the Coast district of British Columbia in 1908 was 1,229,328 tons.

SASKATCHEWAN

The "Annual Report of the Department of Public Works of the Province of Saskatchewan for the Financial Year 1907-08" has recently been made public. It includes the following statistics, relating to the coal-mining industry of the province: During the financial year ended Feb. 29, 1908., there were 19 coal mines in operation, which produced in the 12 months 189,428 tons. There were 232 persons employed inside the mines and 81 outside. Only one nonfatal and two fatal accidents were reported. There were seven new mines opened in the course of the year, and one mine was abandoned. In Saskatchewan, coal mining is only in its beginning; gradual development to operations on a larger scale is in progress.

ONTARIO—COBALT DISTRICT

Temiskaming—The financial statement shows that on Jan. 31 the company had cash on hand and ore in transit valued at $122,761. The output during the fiscal year was 831 tons of ore, which produced 1,026,285 oz. silver of the net value of $494,211. The cost of production was 8.4c. per oz. There were 16,000 tons on the dump of an estimated value of $250,000 to be concentrated.

ONTARIO—PORT ARTHUR DISTRICT

Hanson Consolidated—Active operations have been resumed and prospects are improved by increased railway facilities. Herbert Shear is in charge of the property and reports three carloads of silver ore ready for shipment to the smelters.

Mexico

CHIHUAHUA

Parral Output—Production for the week ending March 12 was 10,010 tons, of which 6550 tons were locally treated. Revised figures show the February output to have been approximately 38,500 tons.

Calamine Mining Company—This company was lately organized on the basis of the Seawell-Robbinson-Terrazas holdings in Los Lamentos district, reached from Ahumada on the Mexican Central railway line. G. V. B. Levings, of Parral, is president, and George B. Squire, secretary and manager. Zinc ore is being marketed in Kansas, and lead ore is shipped to the Monterrey smelter.

San Toy—The report for the year 1908 contains the following items: Sales of ore, $547,209; net returns from ore, $312,961; mining costs, $245,921; net mining profit, $67,040; surplus for year, $52,850; previous surplus, $217,412; profit and loss deficit on Dec. 31, 1908, $164,592.

Capitanena—P. H. Cooper is manager of this and the San Diego mines at Santa Barbara, Gustave Reich having resigned.

Potosi—This Santa Eulalia company is said to be planning the erection of a dry-concentration plant for treating a large tonnage of low-grade zinc ore.

Batopilas—The February output was 300 bars of silver bullion, bringing the total of the first two months of the year to more than 500,000 pesos. The March production will probably be in excess of the previous month.

Hearst Oil Syndicate—Drilling operations have been resumed in the eastern part of the State. A third well has been started near La Mula. J. G. Fallonsbee has general charge of the company's local affairs and L. A. Smith is in direct charge of the drilling work.

Moctezuma—Promising copper properties are under exploitation in this unexplored section in the northern part of the state. The main operations are by the Chihuahua Copper Company, of which James Parker, of El Paso, is manager. Shipments of ore running 9 per cent. copper in car lots have been sent out during the past few months. The region is easy of access by wagon roads from Moctezuma station on the Mexican Central Railway.

SONORA

Greene Gold-Silver—The Humboldt Exploration Company, encouraged by the liberal response of the Greene Gold-Silver Company's stockholders to its proposal, will extend time for the exchange of stock to April 1 next.

Cieneguita Copper—A railroad company has been incorporated to construct a narrow-gage railroad from Tonichi in the Yaqui valley to the company's mines, 40 miles distant in the Sahuaripa district.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 24—The coal trade in the West has shown a little improvement, some spring demand for steam coal being noted; and many industries are apparently needing more fuel than they have for some time. Production is still restricted at many mines and supplies are being fairly well regulated to demand.

In the East the bituminous trade is improving a little, but can still be called quiet. Dealers, however, are hopeful of an early revival, if not of a rapid one.

The anthracite question is still unsolved. There are all sorts of reports about the disposition of the miners to accept the terms which the operators have offered. Nothing definite can be said until after the meeting of the miners' convention. That convention assembled last evening in Scranton, Penn., but it may be two or three days before any final action is taken. The general belief in the anthracite region is that the union men will vote for a strike, but that the majority of the non-union miners would prefer to have no change. The latest statement is that all other demands will be abandoned, provided there is full recognition of the union—that is, a surrender of the open shop.

Proposed Coke Consolidation—A plan has been proposed for the consolidation of a number of independent coke plants in the Connellsville region in Pennsylvania. It is proposed to unite in one company all the plants not controlled by the H. C. Frick Coke Company. Options are said to have been obtained on a number of properties. J. V. Boileau, of Pittsburg, represents the promoters of the scheme.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to March 13, short tons:

	1908.	1909.	Changes.
Anthracite	1,052,936	952,392	D. 100,544
Bituminous	6,561,256	6,850,177	I. 288,921
Coke	1,448,929	1,994,548	I. 545,619
Total	9,063,121	9,797,117	I. 733,996

Shipments of coal by water from Seattle and Tacoma, Wash., in January were 58,356 tons in 1908 and 26,829 tons in 1909; a decrease of 31,527 tons.

Coal passing through lock No. 3 on the Monongahela river in January was 778,400 tons in 1908, and 763,120 in 1909; a decrease of 15,280 tons.

Coal receipts at St. Louis in January were 666,810 tons in 1908, and 621,647 in 1909; a decrease of 45,163 tons.

Chief Mine Inspector Flynn reports coal production in Alabama in 1908 as follows: Jefferson county, 5,254,817 short tons; Walker, 2,522,862; Bibb, 1,180,228; Tuscaloosa, 714,015; Shelby, 369,344; other counties, 433,325; estimate on small mines not yet reported, 500,000; total, 10,974,591 tons. This is a decrease, as compared with 1907, of 3,443,272 tons, or 23.9 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, month of January, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio	1,666,537	353,592	2,020,129
Buff., Roch. & Pitts.	460,988	35,733	496,721
Buff. & Susqueh'na	125,676	22,200	147,876
Penn. lines, N. Y. C.	703,004	8,308	711,312
Pitts. & L. Erie	562,526	344,666	907,192
Norfolk & Western	946,625	225,296	1,171,921
Total	4,465,356	989,795	5,455,151
Total, 1908	4,062,515	558,429	4,620,944

Total increase this year 834,207 tons, or 18.1 per cent. In addition to the above, the Baltimore & Ohio carried 78,452 tons of anthracite in 1908 and 90,099 in 1909; increase, 11,647 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, month of January, short tons:

	1908.	1909.	Changes.
Hocking Valley	185,576	244,945	I. 59,369
Toledo & Ohio Cent.	81,131	96,765	I. 15,634
Baltimore & Ohio	139,103	100,426	D. 38,677
Wheeling & L. Erie	181,611	212,991	I. 31,380
Cleve., Lorain & Wh.	170,549	155,138	D. 15,411
Zanesville & Western	89,267	105,261	I. 15,994
Toledo Div., Pen. Co.	133,613	162,820	I. 29,207
L. Erie, Alliance & Wh.	87,267	96,351	I. 9,084
Marietta, Col. & Clev.	6,237	3,002	D. 3,235
Total	1,074,354	1,177,699	D. 103,345

The total increase this year was 9.6 per cent.

Coal shipments coastwise from the leading Atlantic ports in January are reported as below, in long tons:

	Anthracite.	Bitum.	Total.	Per Ct.
New York	1,247,202	849,900	2,097,102	62.5
Philadelphia	175,414	368,765	544,179	16.2
Baltimore	155,681	115,565	271,246	8.1
Newp't News	.....	207,693	207,693	6.2
Norfolk	.....	236,004	236,004	7.0
Total	1,578,297	1,777,927	3,356,224	100.0
Total, 1908.	1,550,128	1,928,460	3,478,588	.....

Total decrease this year was 122,364 tons, or 3.5 per cent. New York includes all the New York harbor shipping ports.

Coal receipts at Boston, two months ended Feb. 28, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	241,755	192,860	D. 48,895
Bituminous	493,503	449,332	D. 44,171
Total domestic	735,258	642,192	D. 93,066
Foreign	97,602	48,923	D. 48,679
Total	832,860	691,115	D. 141,745

The foreign coal comes chiefly from Nova Scotia. Total decrease this year, 17 per cent.

New York

Anthracite

March 24—The anthracite trade shows no material change. Domestic sizes continue quiet and strike possibilities have not had any effect, as consumers are confident of the ability of the producers to carry them over any period of suspension that is probable. Steam sizes are in demand for the same reason as noted last week. The April discount on prepared sizes is still in suspense.

The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points. Dealers and agents are getting from 10 to 20c. per ton advance on pea and No. 1 buckwheat.

Bituminous

The soft-coal market shows little or no change. Contract talk continues, but business is closed slowly. The far East is waking up a little and making some inquiries, while trade along the Sound is gradually improving. All-rail trade holds its own very well, but without much increase. Transportation and car supply are causing no complaints.

New York harbor is still rather irregular, but buying is not quite so unsteady as it has been. Prices continue $2.40@2.50 per ton, f.o.b. harbor ports, for good steam coal; with $2.20@2.30 for lower grades.

The Coastwise trade is still poor and some owners are talking of laying up their boats rather than to keep them at work at current rates. These rates are unchanged from last week.

Birmingham

March 22—The coal trade in Alabama is quiet. The production is to be farther reduced, if there is no improvement in the demand. There is a large quantity of coke stacked up for any emergency. Some of the larger consumers of coal are holding back and mines are only being operated to meet the demands. The railroads are feeling the falling off in business. There is a gloomy feeling in coal circles in this section.

Chicago

March 23—The coal trade continues firm, but unmarked by special features. Shipments are well held down to prospective needs and the demand has not fallen off for any kind. Steam coals continue about even; domestics are in light demand, the average consumer delaying purchases of anthracite to April and his consumption of bituminous being slack because of the weather.

The tendency is to adjustment of the market to spring conditions, lump falling off and slack coal advancing. In anthracite the small sizes are in much stronger demand. Contract making, in general, is slack, the disposition of consumers being to hold off, in hopes of favorable open-market conditions.

Illinois and Indiana bituminous bring $1.75@2.40 for lump and egg, $1,65@1.75 for run-of-mine and $1.25@1.55 for screenings.

Eastern coals are considerably stronger, demurrage coal being practically off the market. Smokeless lump and egg are not so strong as run-of-mine, which is in less supply and brings $3.05@3.15 for Pocahontas and New River. Hocking is firm at $3@3.15 and Youghiogheny also at $3.15 for ¾-in. gas. Pittsburg No. 8 is a trifle weak at $2.75@2.85 for ¾-in. lump.

Cleveland

March 23—Domestic trade is down and out for the present. Dealers are cleaning up their yards and preparing for next season. A few sales of Massillon lump at $3.25 constitute the record. Steam coals are looking up a little, especially slack, but prices are low. Lake trade has hardly started yet, and looks as if it would have a late beginning this year.

Indianapolis

March 23—At the annual meeting of the Indiana Coal Operators' Association held in Terre Haute March 20, the following officers were elected: President, J. S. Kolsem; vice-president, Hugh Shirkle; secretary, Philip Penna. The new directors elected are Homer Talley, M. M. Gould, John McFadden, Val. Martin and George Nester.

The principal topic considered at the meeting was the supposed intention upon the part of the Steel Corporation to gain control of the coalfields of Vermilion county, Ind., and Vermilion county, Ill., nearest the Gary plant. The plan is believed to be to profit by the impairment of the Deering company, which owns about 30 mines in that territory. It is the policy of the company to get hold of as much coal land as possible for the future. This mission, however, is regarded by Indiana operators with some concern. Some important deals are almost sure to be made in the securing of coal mines and coal lands in Indiana during the present year.

Pittsburg

March 23—The placing of several important contracts this week infused new life into the coal trade and the outlook is somewhat better than it has been for some time. The Crucible Steel Company of America yesterday closed with the Pittsburg Coal Company and the Monongahela River Coal and Coke Company for 500,000 tons of mine-run coal for deliveries running through the year. The Pittsburg & Westmoreland Coal Company closed contracts for 900,000 tons of coal for shipment to the northwestern markets and is among the first of the lake shippers to book orders. This company also took a contract for 100,000 tons of crushed coal for the Montreal Heat, Light and Power Company, Montreal, Canada. The coal is to be crushed at the mine in order to take advantage of the low duty of 15c. per ton.

Prices remain on the basis of $1.15 per ton for mine-run coal at the mine, and slack is quoted at 65@70c. Less than 50 per cent. of production is coming out, except at the river mines, which are running full. A number of tows of empty coal boats and barges arrived this week from lower ports and were sent up to the pools.

Connellsville Coke—Conditions in the coke trade do not show much improvement, but the outlook seems a trifle better. The Pickands-Magee Coke Company has received an order from the Hamilton Steel and Iron Company, Hamilton, Ont., to increase its regular shipments from 300 tons to 600 tons per day, and to add 10 cars daily until further notice. The same company began this week to ship an order of 4000 tons of smelter coke to Tampico, Mexico. The coke is being sent to Baltimore where it is being loaded. The current quotation for smelter coke is $1.40 per ton at ovens. Spot furnace coke continues to sell at around $1.50, and on contract at $1.60@1.75. Foundry coke is quoted at $1.90@2.15 for spot and on contract.

The *Courier* gives coke production in both regions at 252,617 tons. The shipments were 8972 cars, as follows: To Pittsburg district, 3106; to points west of Pittsburg, 5115; to points east of Connellsville, 751 cars.

Foreign Coal Trade

British Coal Production—A preliminary statement gives the production of coal in Great Britain in 1908 at 251,506,379 long tons; a decrease of 6,306,473 tons, or 2.4 per cent., from the previous year.

British Coal Exports—Exports of fuel from Great Britain, with fuel sent abroad for use of steamers in foreign trade, two months ended Feb. 28, long tons:

	1908.	1909.	Changes.
Coal	9,360,445	8,688,934	D. 671,511
Coke	191,762	166,055	D. 25,707
Briquets	259,298	234,938	D. 24,360
Total	9,811,505	9,089,927	D. 721,578
Steamer coal	3,147,257	2,921,409	D. 225,848
Total	12,958,762	12,011,336	D. 947,426

This shows a total decrease of 7.3 per cent. in coal sold for use beyond the limits of the United Kingdom.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on March 13: Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.16; seconds, $1.92. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 24—There is some improvement in the iron and steel trades generally, with a rather better feeling and a more confident tone to the market. The proposed tariff reductions have had really very little effect, partly because they had been discounted, and partly because people generally understand that their effect will not be to bring about any considerable imports, though they may tend to limit increases in price in case of an improvement in business.

In pig iron, furnaces seem to be rather looking for business and, therefore, in accommodating mood about prices. Some orders are reported taken at rather low figures and southern makers have been shading freely, orders being reported placed on a basis of $11 for No. 2 foundry at Birmingham. Northern makers appear to be a little in doubt whether to meet these quotations, especially as no decision has been reached on the prices for Lake ore for the coming season.

In finished material orders are being placed rather freely for structural steel and a number of bridge and building contracts have been closed. It is reported that some orders have been taken as low as 1.10c. at mill for this material. The railroads are not coming forward with rail orders, although bridge contracts are coming in more freely. Two or three large contracts for trolley rails are under discussion.

The Cambria Steel Company has announced a cut of 10 per cent. in wages, and other companies are preparing to follow. The Steel Corporation, however, has made no announcement of its intentions in this respect so far.

Proposed Steel Combination—Reports have been in the air of the consolidation of a number of independent steel plants into one large company. These reports, however, have been denied by representa-

tives of the Jones & Laughlin, the Pennsylvania Steel, the Cambria Steel, the Republic Iron and Steel and other companies which have been mentioned in connection with these rumors.

Baltimore

March 23—Exports for the week included 807,283 lb. zinc dross and 2,273,700 lb. steel billets to Liverpool. Imports included 10,711 slabs of spelter and 842 tons manganese ore from Rotterdam; 3393 tons pyrites from Spain; 6400 tons iron ore from Cuba.

Birmingham

March 22—While there is some little selling of pig iron going on in the Birmingham district, it is admitted that but few, if any, of the companies are selling their make. The quotations are still weak, some of the companies selling the product under $12 per ton, No. 2 foundry, a report having it that $11.50 is not the lowest price, $11 being accepted. The make has been reduced a little lately, one or two furnaces having been blown out. The shipment of pig iron continues good, on business booked before the recent depression set in.

The Bessemer rolling mills of the Tennessee Coal, Iron and Railroad Company have resumed operation after a shutdown of a few weeks. Statements continue to be circulated that the steel plant of the Tennessee company at Ensley will be shut down for repairs and to wait an improvement in general conditions. There has been some selling of steel rails recently from this plant and shipments have been healthy. F. H. Crockard, vice-president of the company, who recently returned from a trip to New York when seen, declined to make any statement.

Chicago

March 23—Pig iron continues dull. Melters are still buying only for immediate needs; they will not contract generally for the future. In consequence, prices are weak, and $12 Birmingham ($16.35 Chicago) represents the basic price of Southern, while $11.50 is said to obtain on such few contracts as are possible. Northern No. 2 is at $16.50, with the demand steadier than for Southern.

Coke shows the pig-iron depression, the best Connellsville selling as low as $4.75. In iron and steel products there is yet no heavy buying generally, though a generally better market probably exists.

Cleveland

March 23—Movement of ore from the docks is increasing and March will record fair shipments to furnaces. More inquiries are coming in about prices for the coming season, but nothing definite has been done.

Pig iron is quiet, but some local orders have been placed at about $15.75, Cleveland, for No. 2 foundry.

In finished material a large shipbuilding order has been placed, which will require a good quantity of plates and shapes. Orders for building and bridge material are coming in quite freely.

Philadelphia

March 24—The pig-iron market is weak and dull, and little business has been done for several days. The outlook is discouraging and makers are not inclined to take a hopeful view of the possibilities for the coming 30 days. Local founders and other buyers are doing very little, but it is reported that outside consumers have taken considerable iron for early delivery. Competition of Southern makers is more keenly felt this week than for some time. Further shadings have been made in several well known brands of Southern iron, but up to this afternoon leading makers here have not followed suit. Basic iron is the only material that holds its own.

Steel Billets—Small lots for immediate use have been contracted for in this territory for early deliveries said to be at $1 per ton below prices named two weeks ago.

Bars—It is rumored that a further shading has been made by one or two mills on refined bar on a basis of 1.40 cents.

Sheets—Makers claim to be booking a fair amount of business.

Pipes and Tubes—Activity prevails in steel pipe and cast-iron pipe, the effect of which is reflected upon this market.

Plates—The rumor of curtailment has no relation to the plate mills. Two or three large orders have come to Pennsylvania mills. The outlook for the steel-plate makers is bright.

Structural Material—It is understood that structural material has been shaded once more, though the fact is not admitted by the manufacturers who claim that the base price of 1.25 to 1.30 will not be departed from.

Scrap—The scrap dealers are obliged to hold everything they have and they are slow to purchase or contract for new supplies except on very favorable terms. Railroads are refusing to sell scrap at present prices. Heavy cast scrap has been called for in small lots, and two or three lots of old car wheels have been sold. The yards are pretty full of material and will be fuller yet.

Pittsburg

March 23—Outside of sheets and tinplate little new business of consequence developed during the week. The American Sheet and Tin Plate Company has started the Greer works, at New Castle, Penn., 20 mills, La Belle works, Wheeling, W. Va., 10 mills, and the Pittsburg works, New Kensington, Penn., 8 mills, increasing the number of active mills to 202, and leaving but one of its plants, the United States at Demmler, Penn., 11 mills, idle; this plant likely will be going next week. The company also has four plants with a total of 29 mills that have not been operated for over two years and will be put on the active list only in the event of extremely prosperous conditions. The company has increased its sheet capacity to 105 mills and now has but 71 idle mills, some of which may be started during the coming week. The independent tinplate mills are operating about the same as before the stiff cut was made in prices and it is reported that most of them are getting satisfactory concessions from steel mills on tinplate bars.

The National Tube Company is operating its plants at around 60 per cent. but in the Pittsburg district the operations are close to 90 per cent. A number of large orders are pending. The Oklahoma Natural Gas Company is figuring on placing an order for 300 miles of 16-in. line pipe, the Pure Oil Company, of Illinois, for 400 miles of 8-in. pipe and the Kansas Natural Gas Company 60 miles of 16-in. pipe.

Officials of the American Steel and Wire Company and the Pittsburg Steel Company, the largest independent wire producer, declare that prices remain the same and no change is contemplated at present. They admit that orders are not coming in as freely as expected. It is rumored, however, that a general readjustment in prices must be made before the jobbers can be induced to buy.

The Carnegie Steel Company is operating its three rail mills to only 25 per cent. of capacity. The mills are busy on structural shapes, a number of important specifications having been received. In structural material it is reported that contracts have been taken as low as 1.10c. at mill.

Pig Iron—The market continues dull and low prices are still being quoted. Pig-iron quotations this week are purely nominal as follows: Standard bessemer, $14.75 @15; malleable bessemer, $14.50@14.75; basic and No. 2 foundry, $14.50, and gray forge, $13.50, all at Valley furnaces.

Steel—Considerable shading of billets is reported but the large producers are holding to $23, Pittsburg. Sheet and tinplate bars are quoted at $25.50 delivered at Youngstown, New Castle, Bellaire, Wheeling, McKeesport and adjacent points, but are said to have been sold within the past few days at a lower price. Merchant-steel bars are still quoted at 1.20c. and plates at 1.40 cents.

Sheets—The market shows considerable improvement since the cut in prices. Prices remain at 2.30c. for black and 3.30c. for galvanized sheets, No. 28 gage.

Ferro-Manganese—Prices remain at $41 @41.50, seaboard, or $43@43.50, Pittsburg.

Metal Market

New York, March 24—Changes have not been material, but there seems to be a slightly better tone to the markets in several directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1909..	$ 8,860,814	$ 3,576,413	Exp. $5,284,401
" 1908..	1,967,597	2,847,133	Imp. 879,536
Year 1909..	16,726,170	6,996,596	Exp. 9,729,574
" 1908..	2,411,797	13,646,617	Imp. 11,234,820
Silver:			
Feb. 1909..	4,852,549	3,508,881	Exp. 1,343,668
" 1908..	4,108,774	3,451,755	" 657,019
Year 1909..	9,394,643	7,173,633	" 2,221,020
" 1908..	8,256,918	7,073,629	" 1,183,289

Exports from the port of New York, week ended March 20: Gold, $6,850,985, principally to Argentina and London; silver, $460,985, chiefly to London. Imports: Gold, $623,594, from France and South America; silver, $55,435, from the West Indies and Mexico.

Gold—The price of bar gold continues 77s. 4d. per oz. in the open market in London; American eagles are in some demand and are quoted 1d. higher at 76s. 5d. per oz. In New York a total of $8,000,000 in gold has been taken for export during the week and the movement apparently is not yet at an end.

Platinum—Business is quiet and there has been no change in prices. Dealers quote $23@24 per oz. for refined platinum, $26 for hard metal and $19@21 for scrap.

Our St. Petersburg correspondent reports, under date of March 4, that the market shows a stronger tendency. At Ekaterinburg quotations are 5@5.05 rubles per zolotnik, for crude platinum, 83 per cent.; at St. Petersburg, 20,300@20,500 rubles per pood. These prices are equivalent to $18.99 and $19.99 per ounce, average, respectively.

Silver—The market has remained fairly steady, with small fluctuations. Pressure from China to sell is much less, and the Indian bazars are regular buyers; but demand has not been sufficient to advance the market. No great change in prices is looked for in the immediate future.

SILVER AND STERLING EXCHANGE

Mar.	18	19	20	22	23	24
New York....	50⅛	50⅛	50¾	50⅝	50⅝	50⅜
London.....	23¼	23¼	23⅛	23¼	23¼	23⅛
Sterling Ex..	4.8825	4.8825	4.8830	4.8830	4.8825	4.8810

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to March 11:

	1908.	1909.	Changes.
India.....	£ 1,425,838	£ 888,000	D. £ 537,838
China.....	496,400	240,000	D. 256,400
Straits.....	78,270	82,800	I. 4,530
Total.....	£ 2,000,508	£1,210,800	D. £ 789,708

Imports for the week £3000 from Chile, £2000 from Mexico, £8000 from the West Indies and £190,000 from New York; £203,000 in all. Exports, £69,500 to India.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
18	12⅛ @12¾	12 @12¼	55¼	28½	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
19	12⅛ @12¾	12 @12¼	55 1/16	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
20	12⅛ @12⅞	12⅛ @12⅜	....	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
22	12⅜ @12⅞	12¼ @12½	56⅜	28⅜	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½
23	12¾ @12⅞	12¼ @12½	56 1/16	28½	3.97½ @4.00	3 82½ @3.85	4.60 @4.62½
24	12¾ @12⅞	12¼ @12½	55¾	28½	3.97½ @4.00	3.82½ @3.85	4.60 @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The lower prices established last week led to more active interest on the part of European buyers, who were stimulated also by speculation for the rise in the standard market. Some fairly large quantities were thus sold for export. This brought out some large buying orders which had been pending from domestic manufacturers, and a firmer tendency developed in consequence. Altogether a good volume of business was done both for foreign and domestic account, both in Lake and electrolytic, but chiefly the latter. There was a good demand for casting copper in the early part of the week, which for a time sold practically on the same terms as electrolytic. Lake copper appears to be in a strong position, probably because of the centralization in the market for this quality, and some sales of fancy brands were made as high as 13c. The market closes steady at 12¾@12⅞c. for Lake; 12¼@12½c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12⅛@12⅜ cents.

Copper sheets, cold-rolled, are quoted 17.3c. per lb., large lots; and hot-rolled, 16.5c. Copper wire, 14¼c. base, carload lots at mill.

A buying movement, due largely to covering of bear accounts, made itself felt in the London standard market, beginning with Thursday of last week. The advance was gradual until Monday morning when prices opened almost £1 higher than at the close on Friday. This marked the culmination of the movement, and since then there has been a reaction, the quotations at the close being cabled at £55 15s. for spot, £56 10s. for three months.

Refined and manufactured sorts we quote: English tough, £60 10s.; best selected, £59 10s.@£60 10s.; strong sheets, £71 10s.@£73 10s.

The production of the Nevada Consolidated from January 1 to March 20 is reported at 3,752,000 lb. of copper. During the same period the Cumberland-Ely reports a total output of 3,278,000 lb. copper.

Copper exports from New York and Philadelphia for the week were 5631 long tons. Our special correspondent gives the exports from Baltimore for the week at 355 tons of copper.

Imports of foreign copper into Germany in January were 11,788 tons, of which 11,125 tons were from the United States. Exports were 552 tons, leaving the net imports 11,236 tons; which is 2924 tons less than in January of last year.

Tin—A waiting attitude seems to be taken by operators in the London market, which does not show any decided tendency one way or the other. Quotations throughout the entire week fluctuated within very narrow limits, and the close is cabled at £129 2s. 6d. for spot, £130 12s. 6d. for three months.

The domestic market is very similar to that of London, and business here is confined to retail lots. Quotations are made at 28.50 cents.

Arrivals of Bolivian tin in Europe in February included 2138 tons concentrates, equivalent to 1407 tons fine tin.

The tin output of the Federated Malay States for the two months ended Feb. 28 was 9275 long tons in 1908 and 6794 in 1909; decrease, 2491 tons.

Lead—There has been a very good demand for this metal, particularly from the sheet and pipe manufacturers, and business is reported in larger volume than for some time past. However, the demand is being readily met at current prices and the close is unchanged at 3.82½@3.85 St. Louis, 3.97½@4c. New York.

The London market, after declining early in the week, showed a better tone and at the close is higher at £13 8s. 9d. for Spanish lead, £13 10s. for English lead.

Advices from Europe indicate that the plans for the European convention to control the production and price of lead are progressing.

Spelter—Business is very light and there is no change in the market, quotations at the close being 4.60@4.62½ St. Louis, 4.75@4.77½ New York. The New York quotation was 4.75@4.77½ for March 18-24, inclusive.

The London market has moved within narrow limits, and after advancing to £21 10s. for good ordinaries, closes at £21 7s. 6d. for that grade, and £21 12s. 6d. for specials.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

World's Production of Copper

The first estimate of the world's production of copper in 1908 comes from Aron Hirsch & Sohn, of Halberstadt, Germany. Substituting our own figures for North America, it appears the total production was approximately as follows:

Country.	1907.	1908.
Germany	24,300	23,300
Austria-Hungary	1,000	1,350
Italy	3,000	3,150
Russia	15,000	16,520
Sweden and Norway	11,964	12,015
Spain and Portugal	51,200	51,700
Turkey	2,600	2,400
Chile	28,000	36,580
Peru	9,500	17,000
Bolivia	2,400	2,500
Cape Colony	7,000	7,000
Australia	46,000	43,000
Newfoundland	2,000	2,000
Japan	37,500	40,000
Others	3,300	5,000
Total	244,764	263,515
United States	392,519	425,177
Mexico	56,567	37,571
Canada	20,695	23,881
Grand total	714,545	750,144

Apart from the conditions in the United States, Canada and Mexico, as to which we have previously commented, the most noteworthy features of the above statistics are the large increases in the outputs of Chile, Peru and Japan.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, two months ended Feb. 28, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.	
Copper	21,895	10,510	Imp.	11,385
Copper, 1908	22,538	13,265	Imp.	9,273
Tin	7,150	6,658	Imp.	492
Tin, 1908	6,666	6,402	Imp.	264
Lead	37,823	6,338	Imp.	31,485
Lead, 1908	38,353	9,589	Imp.	28,764
Spelter	16,915	1,153	Imp.	15,762
Spelter, 1908	15,897	1,096	Imp.	14,801
Quicksilver, lb.	409,157	171,786	Imp.	237,371
Quicksilver, '08	821,650	476,021	Imp.	345,629
Ores:				
Tin ore and con.	2,587	.....	Imp.	2,587
Tin ore, 1908	4,559	.....	Imp.	4,559
Pyrites	136,790	.....	Imp.	136,790
Pyrites, 1908	168,036	.....	Imp.	168,036

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished 83 tons copper matte, 2980 tons fine copper and 5038 tons lead.

Other Metals

Antimony—No business is reported. In the absence of sales, prices are nominally unchanged at 8@8⅛c. for Cookson's; 7⅞c. for Hallett's; 7⅜@7⅝c. for ordinary brands.

Aluminum—The Aluminum Company of America quotes 24c. base for No. 1 ingots; 33@34c. base for sheets. Nothing new reported as to foreign metal.

Quicksilver—Business has been quiet. New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco prices are $44@45 for domestic sales, $42 @43 for export. London quotation £8 7s. 6d. per flask, with 1s. 3d. less named by second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Zinc and Lead Ore Markets

Joplin, Mo., March 20—The highest price reported paid was $40.50 per ton for concentrate carrying 63 per cent. zinc sulphide on car sample assay, sold on a basis of $37.50. As high as $38 base was paid and nothing was reported sold in quantity under a $36 base. The most material advance of prices was in medium and lower-grade sulphides. Zinc silicate sold on $18 and $19 per ton of 40 per cent. zinc, selling as high as $24. The average price, all grades, was $32.50 per ton.

Lead ore was generally advanced $1 per ton, while some large sales were made at the week end, but not delivered, at a $2 gain, bringing $52.50 f.o.b. cars. Medium grades ranged between $50.50 and $51.50; all grades averaged $50.80 per ton.

The smelters now own the bulk of the stock in the bins at the mines, and will need to buy but lightly for a few weeks, which will have a tendency to offset the momentary excitement attending the report on the tariff.

SHIPMENTS, WEEK ENDED MAR. 20

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,461,110	955,100	$ 88,385
Joplin	1,659,310	353,070	40,115
Miami	370,760	542,550	19,025
Duenweg	944,670	36,610	18,409
Galena	717,160	50,050	13,885
Alba-Neck	658,740	.....	12,515
Prosperity	272,680	180,770	9,552
Carthage	485,750	.....	9,228
Spurgeon	453,820	103,460	8,997
Granby	521,050	27,700	7,570
Aurora	360,260	.....	5,098
Quapaw	231,280	.....	3,700
Sarcoxie	265,490	.....	3,513
Badger	163,380	.....	3,104
Oronogo	123,520	9,770	2,525
Zincite	110,100	3,350	2,065
Cave Springs	74,210	.....	1,410
Carl Junction	51,530	.....	1,005
Totals	10,934,820	2,262,430	$250,101
Twelve weeks	133,044,400	20,664,210	$2,913,925
Zinc value, the week, $192,562; 12 weeks,			$2,387,991
Lead value, the week, 57,539; 12 weeks,			525,934

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	.....	34.19	.....	49.90	.....
April	35.40	.....	34.08	.....	52.47	.....
May	34.19	.....	33.39	.....	56.05	.....
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., March 20—The base price paid for 60 per cent. zinc ore was $38 per ton. No premium price is reported. For 80 per cent. lead ore $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 20

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	388,000	.....	209,200
Linden	305,290	.....	.....
Benton	164,350	.....	.....
Strawbridge	154,000	.....	.....
Hazel Green	151,700	66,700	.....
Galena	88,000	.....	.....
Livingston	80,000	.....	.....
Cuba City	71,150	.....	.....
Total	1,402,490	66,700	209,200
Year to Mar. 20	21,767,729	777,880	2,189,850

In addition to the above there was shipped to the American Zinc Ore Separating Company, 129,670 lb. and to the Joplin Separator Works, 482,600 lb. zinc ore. The shipment of zinc ore is still curtailed about 25 per cent. on account of the bad condition of the wagon roads; a number of outlying mines, with bins filled, are unable to get any of their stock to market.

Chemicals

New York, March 24—The market is extremely dull, but prices hold to last week's figures.

Copper Sulphate—Prices remain at $4.60 per 100 lb. for carload lots and $4.85 for smaller lots. No large sales reported.

Arsenic—Quotations on white arsenic are 3c. per lb. No trading of any moment is noted.

Nitrate of Soda—Prices remain at 2.15 @2.17c. per lb., with few sales made.

Mining Stocks

New York, March 24—Early in the week the general stock markets generally remained quiet and uncertain, but on Monday a strong upward movement developed, chiefly based on good buying in London of American securities. This strength continued and the market has been active, although today has showed a slight reaction. The anthracite-coal stocks weakened a little on strike rumors. The general tone of the market is strong.

On the Curb the leading incident in the first part of the week was a break in Ohio Copper under the influence of heavy selling. This lasted only for a couple of days, and the stock lapsed into quietness again. Toward the close the other copper

stocks showed considerable strength and were fairly active. The Cobalt stocks were generally in demand and brought good prices. The Nevada gold stocks are waking up a little, more attention being paid to them, but prices are not strong.

Boston, March 23—A dull and uninteresting market is all that can be said of the present conditions. Weak at times and then a degree of strength in certain stocks. The weakness in part is said to have been due to the liquidation of some 12,000 shares of mining stocks for Western account. Notwithstanding this, declines were of little consequence, and prices tonight are generally above those of a week ago. There was some selling of Atlantic, Lake and North Lake for exchange into East Butte.

The Tamarack company is said to have a floating indebtedness of $700,000, which was the reason that Calumet & Hecla people did not take the property over with the other Bigelow mines. The Isle Royale annual report shows a deficit of $451,211 for the year 1908. This included $309,460 spent for construction, etc.

On the Curb First National fell to $6. Ohio Copper had a bad break to $6, but is back to above $7. Ojibway has been taken from the Curb and placed on the unlisted department of the Stock Exchange. An issue of $250,000 bonds is announced by the Black Mountain Mining Company to retire a floating indebtedness and provide working capital.

STOCK QUOTATIONS

NEW YORK Mar. 24	
Name of Comp.	Clg.
Alaska Mine	.22
Amalgamated	69⅞
Anaconda	42
Balaklala	†2½
British Col. Cop.	6⅛
Buffalo Mines	†3
Butte Coalition	23¾
Colonial Silver	⅛
Cum. Ely Mining	7¾
Davis Daly	4⅛
Dominion Cop.	⅛
Douglas Copper	2¾
El Rayo	2⅞
Florence	3½
Foster Cobalt	.34
Furnace Creek	.11
Giroux	7⅞
Gold Hill	⅛
Goldfield Con	7½
Granby	95
Greene Gold	⅛
Greene G. & S.	7
Guanajuato	1⅜
Guggen. Exp.	175
Hanapah	.15
Kerr Lake	7⅛
McKinley Dar.	.85
Miami Copper	13¾
Micmac	1⅛
Mines Co. of Am.	⅛
Mitchell Mining	⅛
Mont. Sho. C.	1⅝
Nev. Utah M. & S.	3
Newhouse M. & S.	3⅝
Nipissing Mines	10⅞
Old Hundred	⅜
Silver Queen	.50
Stewart	¾
Tennessee Cop'r.	41
Tri-Bullion	1⅛
Union Copper	1
Utah Apex	6⅛
Utah Copper	41⅜
Yukon Gold	4¼

*Ex. Div. †Ex. Rights.

BOSTON Mar. 24	
Name of Comp.	Clg.
Adventure	7⅛
Allouez	39
Am. Zinc	23½
Arcadian	‡4¾
Arizona Com.	35¼
Atlantic	13¼
Boston Con.	‡11⅛
Calumet & Ariz.	101
Calumet & Hecla	625
Centennial	‡29
Con. Mercur	‡.30
Copper Range	75¼
Daly-West	10½
East Butte	14¾
Franklin	14¼
Greene—Can.	9¼
Isle Royal	26⅝
La Salle	14½
Mass.	4½
Michigan	‡10
Mohawk	61
Nevada	17⅝
North Butte	68⅝
Old Colony	.60
Old Dominion	50
Osceola	128
Parrot	32⅛
Quincy	88
Rhode Island	‡4¾
Santa Fe	‡2⅛
Shannon	14
Superior	42⅛
Superior & Pitts.	13⅜
Tamarack	77½
Trinity	13⅞
United Cop., com.	13
U. S. Oil	31
U. S. Smg. & Ref.	‡40
U.S. Sm. & Re., pd.	45¼
Utah Con.	40¾
Victoria	4½
Winona	5¾
Wolverine	141
Wyandotte	2½

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡36¾
Am. Smelt. & Ref.	86¼
Am. Sm. & Ref., pf.	103½
Colo. Fuel & Iron	32¼
Federal M. & S., pf.	80
National Lead	76⅞
National Lead, pf.	‡106½
Pittsburg Coal	‡10¼
Republic I. & S.	‡20½
Republic I. & S., pf.	70⅞
Sloss-Sheffield	‡72
Standard Oil	665
U. S. Steel	44⅝
U. S. Steel, pf.	110¾
Va. Car. Chem.	42¾

BOSTON CURB	
Ahmeek	146
Black Mt.	1⅛
Chemung	18
Globe Con.	7⅝
Hancock	11⅜
Helvetia	3¼
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	14
Superior & Bost.	15½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Mar. 20		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.07	.05
Center Cr'k	1.60	1.40
Cent. C. & C.	83.00	82.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.20	.17
St. Joe	12.00	11.00

LONDON Mar. 24			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton's Ind.	0	2	9
Camp Bird	0	16	0
Esperanza	2	16	3
Tomboy	0	18	0
El Oro	1	4	0
Oroville	0	10	3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 24.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.37	St. Ives	.10
Best & Belcher	‡.32	Triangle	.02
Caledonia	.12	BULLFROG STOCKS	
Challar	.08	Gibraltar	.03
Comstock	.25	Homestake King	.05
Con. Cal. & Va.	.61	Mont. Shoshone C.	1.25
Crown Point	‡.45	Tramp Cons.	.04
Exchequer	.22	MISCELLANEOUS	
Gould & Curry	.10	Bonnie Clare	‡.03
Hale & Norcross	.19	Lee Gold Grotto	...
Mexican	.62	Nevada Hills	1.12½
Ophir	1.02½	Nevada Smelting	1.00
Overman	.10	Nevada Wonder	.80
Potosi	.08	Nevada-Utah	2.87½
Savage	.12	Penn-Wyoming	.03
Sierra Nevada	.24	Pittsburgh S. Pk.	.65
Union	.22	Rawhide Caol't'n.	.64
Utah	.03	Round Mt. Sphinx	.07
Yellow Jacket	.54		
TONOPAH STOCKS			
Belmont	.80		
Extension	.63		
Golden Anchor	‡.01		
Jim Butler	.18		
MacNamara	.32		
Midway	.20		
Montana	.66		
North Star	.04		
Tono'h Mine of N.	6.75		
West End Con.	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.10		
Blue Bell	.03		
Booth	.16		
Columbia Mt.	.10		
Comb. Frac.	.92		
Con. Red Top	.07½		
Cracker Jack	.02		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.03		
Goldfield Daisy	.42		
Great Bend	.16		
Jumbo Extension	.10		
Kendall	.05		
Lone Star	.04		
May Queen	.03		
Oro	.08		
Red Hill	.08		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS Mar. 19	
Name of Comp.	Clg.
Acacia	6¼
Black Bell	....
C. C. Con.	‡3½
Dante	6¼
Doctor Jack Pot	9¼
Elkton	71¼
El Paso	49
Findlay	15
Gold Dollar	13
Gold Sovereign	3
Isabella	24¼
Index	....
Jennie Sample	8
Jerry Johnson	6⅜
Mary McKinney	38
Pharmacist	3½
Portland	.90
Un. Gold Mines	5
Vindicator	74
Work	7¼

Assessments

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	Mar. 10	Apr. 10	$0.05
Cedar Creek, Ida.	Mar. 3	Apr. 5	0.003
Challenge Con., Nev	Mar. 19	Apr. 9	0.00½
Comet G. & C., Ida.	Mar. 20	Apr. 20	0.001
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crater, Ida.	Feb. 23	Mar. 27	0.001
Gov't Gulch, Ida.	Mar. 9	Apr. 9	0.001
Hypotheek, Ida.	Mar. 11	Apr. 12	0.005
Mexican, Nev	Apr. 8	Apr. 29	0.10
Mineral Farm, Ida.	Mar. 12	Apr. 10	0.003
North Franklin, Ida.	Mar. 15	Apr. 15	0.005
Reliance, Ida.	Mar. 23	Apr. 20	0.001
Savage, Nev.	Apr. 8	May 5	0.10
Silver Hill, Nev.	Feb. 25	Mar. 30	0.05
Spanish Ridge, Cal.	Feb. 11	Apr. 10	0.03
Union Con., Nev	Apr. 8	Apr. 30	0.10
Western Star, Ida.	Mar. 5	Mar. 27	0.003
Yellow Jacket, Nev.	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.197
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.